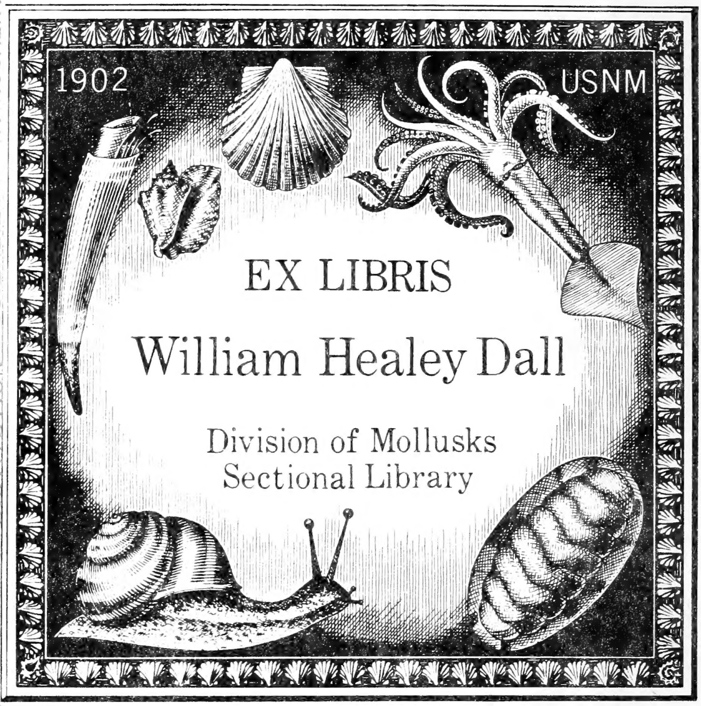
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PROCEEDINGS

OF THE

Boston Society of Natural History.

VOL. XVIII.

1875–1876.

BOSTON:
PRINTED FOR THE SOCIETY.
1877.

PUBLISHING COMMITTEE.

S. H. Scudder, | S. L. Abbot, M.D.,
A. Hyatt, | Edward Burgess,

Thomas Dwight, M. D.

CONTENTS OF VOL. XVIII.

PROCEEDINGS

OF THE

BOSTON SOCIETY OF NATURAL HISTORY.

TAKEN FROM THE SOCIETY'S RECORDS.

Annual Meeting, May 5, 1875.

Vice-President Mr. S. H. Scudder in the chair. Thirty-two persons present.

Prof. Alpheus Hyatt, Custodian, presented the following report: —

The changes in the furniture of the building, described in the last Annual Report, have been completed. More than half of the cases are now secured against the entrance of dust and insects, and the most valuable preparations can be safely trusted to their protection. If any member of the Society will take the trouble to walk through our rooms, he will easily satisfy himself of the necessity of these changes. The condition of the collections which still remain in the old cases, whose loose doors cannot be secured either against dust or insects, show this very plainly. The tablets in the Paleontological and Conchological collections, though but recently completed, are more or less disfigured by dust, and where more perishable specimens exist, as among birds and mammals, the amount of damage done will, in a few years, be irretrievable. The alterations were completed last July, and the work of removing the collections was carried on as fast as each room or gallery was made ready for occupation.

Mr. Emerton was occupied during the summer in removing the Geological collections and the collections of sponges, corals and echinoderms.

The minerals displayed have been rearranged by the President, Mr. Bouvé, many specimens, formerly stored in trays for want of space, having been added. They now make a most attractive display in the newly furnished room on the right of the main entrance. The gallery of this room is occupied by a special collection of the minerals of New England, arranged by Mr. Bouvé. In the next room the same gentleman is at present engaged in revising and completely rearranging the Geological collection. This work is advancing very rapidly, and is already more than half done.

The Eser Paleontological Collection, presented to the Society by Vice President Mr. John Cummings, was removed by Mr. Rathbun, during last June, into the northeast corner room of the main hall. It is now being thoroughly revised by Mr. Crosby, and rapidly mounted for exhibition by Miss Carter, for whose efficient services we are indebted to the generosity of Mr. Cummings. This revision also includes the incorporation of all the European specimens formerly included in the general Paleontological collection, and the completion of a catalogue.

Mr. Crosby is also engaged in the revision of the American collection, and this is now being mounted by Miss Washburn, for whose desirable assistance we have also to thank Mr. Cummings. This work includes the naming and mounting of the Henry D. and Wm. B. Rogers collections, principally of fossils from Pennsylvania, the Cleveland collection of Devonian specimens, and the formation of an educational collection from the duplicates. The latter is progressing rapidly, and will soon be as complete as the Society can afford to make it.

The Rogers Collections have suffered much damage from the loss of labels; this is particularly the case with the Henry D. Rogers collection, which was packed with the greatest carelessness by the parties entrusted with its transmission to America, after the death of Prof. Rogers in Glasgow. The sudden illness of Mr. Wm. B. Rogers in the midst of his labors, unfortunately left his own collection also in great disorder. But it is a matter of sincere congratulation that this honored member of our Society has so far recovered from his illness as to be again able to work with us. He has already reviewed the labels of a portion of his own collection, and expects to be able to continue his efforts until the whole of his own and his brother's collections have been revised. The southeast corner room in the basement was fitted up partly with the old cases which were removed from the former botanical room, and partly with the cabinets of the Rogers collections, and now serves as a general work room, as a lecture room and laboratory for the students of the Institute of Technology, and also as a storage room for the Rogers collections and the Educational collection. It makes a valuable addition to the working facilities of the Museum, and, in fact, is indispensable, since there is no other room in the building suitable for the general purposes of a laboratory.

During the summer the Custodian, assisted by Mr. Rathbun, worked for the U. S. Fish Commission, under the charge of Prof. S. F. Baird, to whom we are indebted for the ample opportunities for collecting which were given to us. The department of Marine Zoology and the Laboratory were under the immediate charge of Prof. A. E. Verrill, whose kindness and readiness to assist us we also desire to acknowledge with many thanks.

The service heretofore rendered by Prof. Baird to zoological science has been of general usefulness, but none, it seems to me has been of such wide-spread and growing importance as this one. He has been able by careful management not only to promote the main object of the Commission in the most economical manner, but at the same time to place within the reach of naturalists complete facilities for the exploration and study of the Marine Fauna of New England. Mr. Rathbun assiduously attended to the general dredging and shore collecting, accurately labelling every specimen. The valuable additions thus made to our New England collection have been since revised and placed in the most complete order.

The New England collection of shells has also been remounted and greatly enlarged by the same assistant, who has accompanied this work with complete lists, which will enable him to perfect this department as fast as opportunities for collections will permit. Unfortunately, there are at present no cases in which these beautifully mounted specimens can be exhibited.

The collection of New England Sponges, to which the Custodian paid special attention, has been much enlarged, and colored figures were made of every species, which will be used in the illustration of the collection.

A small donation from our former Vice President, Mr. R. C. Greenleaf, enabled us to begin a very important and long contemplated improvement in the illustration of our collection by means of anatomical models. Drawings were made of several of the living animal forms of the Mollusca by Mr. Rathbun, which have since been used in the manufacture of models. Several of these, showing the animal as it actually appears when living, have been completed. When this series is finished there will be another begun, representing the internal parts as they appear when the shell is removed. The experiment has shown the practicability of rendering our collections useful as a means of conveying accurate knowledge to general students, teachers, and the public. These models also will be appreciated by no one more highly than by the strictly professional naturalist, who must be a specialist of exceptional ability if he cannot gather new information from collections illustrated in this comprehensive way. It must be remembered, however, that the accurate study of all the species of a group unavoidably precedes the selection of the types and the moulding of the models. Miss Pratt's bequest has enabled us to do this with considerable rapidity among the Mollusca, but the insufficiency of the funds in every other department of the Museum will postpone indefinitely the completion of all other collections.

We have a fine building admirably adapted for its purpose, excellent collections, all those things which are most costly and most difficult to obtain. There is nothing, in fact, to prevent us from speedily possessing the most perfect Museum of our own class now in existence, except the want of funds to employ a sufficient number of competent assistants to work up the collections.

The Teachers' School of Science was resumed in the autumn of the past year, and has been successfully continued and liberally supported by donations from Mr. Cummings. A course of about thirty lessons upon Mineralogy has been given by Mr. L. S. Burbank, of Lowell, and the usual plan of giving away the specimens used at the lectures has been followed. Nearly a hundred sets of minerals have been distributed among the teachers of the public schools of Boston. In order to test the practical results of these gifts, Mr. Burbank was requested to collect statistics of the extent to which the materials had been used. The returns showed that in as many as fifty instances the collections were being intelligently employed in the instruction of students. The Society can therefore congratulate itself upon being the birthplace of the first really practicable movement for introducing the study of the Natural Sciences into the public schools of Boston.

The Botanical Collection has received daily attention from Mr. Cummings, and has been much improved by his own work and that of his assistant, Miss Carter. The general collection of plants has been rearranged by Miss Carter, and also the collection of specimens of wood, fruit, etc.; and the latter have been placed in the new show-cases, immediately over the closed cases containing the general botanical collection.

The Lowell Collection was found to be in very poor condition, many plants having been destroyed by insects. It has, however, all been rearranged, the duplicates have been picked out, and it now remains only to poison the specimens in order to place the collections in perfect order. Mr. Cummings and Miss Carter have also about half completed a New England collection out of the duplicates of the general collection, which will be entirely finished and catalogued during the coming year.

A beautiful as well as valuable addition to this department has been made by Mr. Edward T. Bouvé. It consists of preparations of the leaves and stems of New England trees and shrubs, pressed between panes of glass, so that they can be readily studied without injury to the specimens. These will be accompanied by other specimens of the wood and bark, and will occupy a prominent place in the collection of New England plants. About one hundred species have been so prepared, and the whole list will probably be completed and exhibited during the coming year.

Among the donations which may be considered worthy of mention is one of birds, shells and insects, received as a bequest from the family of a deceased fellow member, Mr. F. P. Atkinson. Although very young, Mr. Atkinson had already shown much interest in the study of Natural History, and had attracted the friendly attention of many of the members of this Society, who deeply regret his early death.

The most important acquisition of the year, and also the last which it is my duty to record, came to us by the bequest of our former President, Prof. Jeffries Wyman. This distinguished Comparative Anatomist, deeply lamented by the members of the Society, was accorded the exceptional honor of a Memorial Meeting. The ceremonies of this meeting were made impressive by a respectful solemnity and a depth of feeling which will long be remembered by the Society. By his will the entire collection of anatomical specimens formerly exhibited in Boylston Hall, Cambridge, was left to the Society, conditionally, upon the payment of three thousand dollars. After much deliberation the Council decided to give a larger sum, out of consideration for his memory and the intrinsic value of the collection. They accordingly voted five thousand dollars, which has been paid to the heirs, and the collection is now being incorporated with our own, and undergoing a thorough rearrangement under the charge of the Chairman of the Committee on Anatomy, Dr. Thomas Dwight. A more detailed report will therefore be necessarily postponed until this work has been finished.

The Secretary reports as follows: —

The evening lectures, endowed from the Lowell fund by Mr. John A. Lowell, have somewhat changed their character on account of the increased price which it is now necessary to pay for lecturers. They have been reduced in number from forty to twenty. This year the courses have been as follows: — Six upon "The Chemistry of the Waters," by Dr. T. Sterry Hunt; six upon "Injurious Fungi," by Dr. W. G. Farlow; six upon "American Archæology," by Mr. F. W. Putnam; and two upon the "Village Indians of New Mexico," by Mr. Ernest Ingersoll.

MEETINGS.

There have been eighteen general meetings, with an average attendance of fifty-four persons; five meetings of the Section of Microscopy, with an average attendance of eight persons; six meetings of the Section of Entomology, with an average of seven persons. On two occasions one hundred and fourteen persons have been present at the general meetings. One Honorary, four Corresponding and thirty-seven Resident Members have been elected. Seventy-five communications have been presented.

PUBLICATIONS.

Since the last Annual Meeting, two quarterly parts, each of Volumes XVI and XVII of the Proceedings, have been issued, and Part III of Volume XVII is also nearly ready for distribution. Each part of Volume XVII has one-third more than the usual amount of matter. Four articles have been published in the Memoirs, making one hundred and thirty-two pages, with three plates. Three others (with two plates) are already in press. The articles that have already appeared are, "Recent Changes of Level on the Coast of Maine," by Prof. N. S. Shaler; "The Species of the Lepidopterous Genus Pamphila," by Mr. S. H. Scudder; "Antiquity of the Caverns and Cavern Life of Ohio Valley," by Prof. N. S. Shaler; "Prodrome of a Monograph of the Tabanidæ," by Baron C. R. Osten Sacken.

LIBRARY.

The additions during the last year number 1397, and may be classified as follows:—

	8vo.	*4to.*	*Fol.*	
Volumes	232	65		297
Parts	575	242	3	820
Pamphlets	234	23	4	261
Maps and Charts				19
Total				1397

The Society has opened exchanges with the following-named Societies and Journals:—

Belfast Naturalist's Field Club.
Academia Nacional de Ciencias Exactas existente en la Universidad de Cordova.
Cincinnati Quarterly Journal of Science.
Société d'Études Scientifiques de Lyon.
"The Academy," London.
Feuille des Jeunes Naturalistes, Paris.
Società Adriatica di Scienze Naturali in Trieste.
Wisconsin Academy of Sciences, Arts and Letters.
The American Sportsman (now The Rod and the Gun).
Cambridge Entomological Club.

During the year the Societies mentioned below have sent extensive series of their earlier publications.

The Literary and Philosophical Society.	Liverpool.
Naturforschende Gesellschaft	Emden.
The Literary and Philosophical Society	Manchester.
Kongelige Danske Videnskabernes Selskab	Kjöbenhavn.

Number of persons taking books, 109; number of books taken out, 835; a large increase on previous years.

REPORTS ON SPECIAL COLLECTIONS.

MOLLUSCA.

The work of revising the general collection has been commenced, and quite largely carried out. The plan is essentially this: to retain in the display cases only the more typical forms of each genus and subgenus, and to attempt to illustrate no differences lower than those of generic value. The character of the animal of each family is represented, wherever possible, by a model of one of the typical forms. So far, eleven families, one of Gasteropods, Naticidæ, and ten of Lamellibranchs, commencing with the Pholadidæ, have been worked over in this manner, and eight models have been made. To more fully explain the plan, I give here an analysis of the work done upon the Naticidæ. Nine genera and three subgenera are admitted in this family by Dr. P. P. Carpenter, and also by H. & A. Adams, in their "Genera of Recent Mollusca." The genera are Natica, Lunatia, Nerita, Ampullina, Naticella, Polinices, Naticina, Cryptostoma, Amaura; the subgenera, Stigmaulax, Acrybia, Sigaretus. To illustrate the genus Natica we have selected eight species, representing the more marked differences in form and in color which occur within the genus; but this number might be much reduced. The species chosen are *canrena*, *labrella*, *lineata*, *maroccana*, *millepunctata*, *stercus-muscarum*, *spadicea* and *vitellus*. For the subgenus Stigmaulax the species *sulcata* is used. For the genus Lunatia, *monilifera*, *castanea*, *metastoma*, *Raynauldiana* and *solida*, and so on through the remaining genera and subgenera. The genus Amaura and the subgenus Acrybia are not represented in the general collection, but are contained in the New England collection. A note in the catalogue indicates this fact, and states where they may be found. It is intended to illustrate all the genera of each family in this manner. The models are made in the ordinary way of constructing plastic models. The animal is first built up in clay from drawings, and then transferred to plaster by means of a gelatine mould. It has been found most satisfactory to work the model up only roughly in the clay, and finish all the details in the plaster cast. In many cases it has been possible to imitate the appearance of the surface of the body of the animal by covering the plaster with a thin coating of wax before putting on the paint.

For representing the animal of the Naticidæ, one of the more common New England forms, *Lunatia heros* was chosen. The animal is represented crawling on the sand, with the operculum lobe covering about half the shell, and with the mentum thrown up well in front. The body is shown as if much distended with water so as to have a length equal to about three times that of the shell.

Of the models of Lamellibranchs made, those forms possessing open mantles are represented as lying on the side with one valve imbedded in the sand, and with the siphons, foot and mantle lobes quite fully extended. Of those with closed mantles some lie on the side, but others are inclined backward, so as to show a portion of both valves. In some groups, as the Corbulidæ, where no large shells exist, no attempt has yet been made to model the animal. Each model is placed in the case with the family in which it belongs, and, where possible, New England forms have been chosen for modelling.

The families of Lamellibranchs represented by models, are as follows: — Pholadidæ by *Dactylina dactylus*, of natural size; Teredinidæ by *Teredo navalis*, enlarged over four times, and represented as if lying in its burrow in a section of wood; Solenidæ by *Ensatella americana*, the American razor shell; Myadæ by *Mya arenaria*, the common clam of New England, with the united siphons extended one and one-half times the length of the shell; Mactridæ by *Mactra* *solidissima*, a common New England clam; Tellinidæ by *Scrobicularia piperita*; the only reason for taking this form to illustrate the family Tellinidæ was that figures of no other good forms were accessible; Veneridæ by *Callista Chione*, a very common European mollusk— it is proposed to make soon a model of our *Venus mercenaria*, to further illustrate the family; Cyprinidæ by *Cyprina islandica*, the only species at present recognized in the family.

The collection of New England shells has been entirely revised and remounted, the color of the tablets having been changed from black to dark blue, and the labels rewritten.

Most of the general collection has been received from Dr. Carpenter; but he still retains, and is at work upon, several groups, including the Neritidæ and Cerithiadæ. He has not yet completed his work upon the duplicate collections, and they also remain in his possession.

Besides the catalogue of the general collection in course of preparation by Dr. Carpenter, there has been made out the past year for the use of the Society, a general catalogue of the New England collection, and a catalogue of the testaceous mollusca known to have been found on the New England coast. The latter was compiled from the several works on New England Zoology.

The principal additions to the collection of Mollusca, recorded for the past year, are: — A lot of about one hundred species of dried specimens of lamellibranchs and gasteropods, collected in Florida and the Bahamas, by Dr. E. Palmer, and obtained for the Society by purchase; a number of foreign marine shells from the relatives of the late Mr. F. P. Atkinson; and many marine or fresh water shells, mostly from the Southern States, contained in the collection of the Messrs. H. B. and W. D. Rogers; besides the large collection made by the Custodian and Mr. Rathbun, while with the U. S. Fish Commission, at Noank, Conn., during the summer of 1874.

INSECTS.

All Harris's North American insects, except the Neuroptera and part of the Diptera, are now in the two black walnut cases built for them. Twenty of the drawers were fitted, three years ago, with sliding covers, and are as safe as any boxes in the Museum, but the remaining forty drawers are loosely covered, and the specimens in them are more or less injured every summer by moths and Anthreni. The Neuroptera were revised by Dr. Hagen, and remain in the four glazed boxes where they were put by him.

Mr. Sprague began a revision of the Coleoptera, and finished it through the Staphylinidæ, six hundred and fifty-five species. The Histeridæ, named by Dr. Horn, were returned after Mr. Sprague's death. The succeeding families, as far as the Tenebrionidæ, about one thousand species in all, were removed from the drawers, and a new arrangement of them begun by Mr. Sprague. These have all been returned to the drawers, and Mr. Sprague's arrangement followed as far as possible, but no change of labels has been made. The rest of the Coleoptera remain as they were arranged by Mr. Scudder, with Harris's family and general labels, and Mr. Scudder's catalogue numbers. The European Coleoptera and Lepidoptera from Harris's collection are in three boxes covered with paper, among the foreign insects.

Mr. Sprague began several collections of beetles, described in the Society's publications, of which the types are lost. The collection of Randall's species, described in Vol. II of the Journal, contains sixty-three species out of the eighty-two described. A list of these with notes was found among Mr. Sprague's papers, and has been revised by Mr. Austin for publication in the Proceedings.

There are also unfinished collections of the species of Cicindela of Massachusetts, described by A. A. Gould in Vol. I of the Journal, of the species of Hispa, described by Harris in Vol. I, and of the Coleoptera, described by Say in the same volume. A collection of Carabidæ, described by Kirby in Fauna Boreali-Americana, was made by Mr. Sprague, and compared with the types in the British Museum by Mr. E. C. Rye. This collection was returned just before Mr. Sprague's sickness, and was not rearranged by him. It has been transferred to a glazed box with the labels of Mr. Sprague and Mr. Rye.

Another work begun by Mr. Sprague was a revision of the New England collection of Coleoptera, but he only carried it through the Cicindelidæ and Carabidæ. The former are now on exhibition, illustrated by a drawing of *C. vulgaris*; the latter occupy three glazed boxes in the work room. The rest of the New England Coleoptera remain as arranged and labelled by Mr. Sanborn. The collection of beetles left the Society by Mr. Dale, was examined by Mr. Sprague, and such specimens as were needed in the Museum placed in other boxes, leaving a large number of duplicates in the book-shaped boxes used by Mr. Dale, where they are liable to be destroyed by Anthreni.

During the last year all the New England Hymenoptera and Neuroptera have been put on exhibition. Part of the Geometridæ have been taken to Salem by Dr. Packard, and returned named. The Noctuidæ, about two hundred and fifty species, have been named and arranged by Mr. Morrison.

The duplicate and unarranged New England insects, occupying thirty boxes and five hundred bottles, are all arranged by families in the workroom, the boxes containing pinned specimens covered with paper for safety.

Nearly all the foreign Coleoptera are now in glazed boxes, where they are comparatively safe; the remainder of the collection, consisting principally of Lepidoptera from South and Central America, is in small boxes, which have to be covered with paper every summer to avoid injury. Some three hundred bottles of foreign insects in alcohol are in the workroom, besides a few on exhibition in the Museum.

The collection of native spiders in alcohol, begun by Mr. Sanborn, now contains one hundred and thirty species, including all the common species in the neighborhood of Boston. During the last year a collection of dried spiders for exhibition was begun by Mr. Emerton, and now contains specimens of thirty-eight of the larger species. Eighty microscopic specimens of palpal organs and other parts of spiders, described by Hentz, have been prepared.

The foreign spiders are all in the exhibition case in the northeast room, none of them named. The Scorpions and Phrynidæ are in the same case. The number of specimens is large, but of few species, and none are named.

The Treasurer presented the following report.

Report of E. Pickering, Treasurer, on the Financial Affairs of the Society, for the year ending April 30th, 1875.

Receipts.		
Dividends, Interest and Rents		$4,988.31
Courtis Fund Income		692.00
Pratt Fund Income		840.00
H. F. Wolcott Fund Income		464.00
Walker Fund Income		2,788.40
" Prize Fund Income		278.00
" Grand Prize Fund Income		60.00
Entomological Fund Income		30.00
Bulfinch Street Estate Fund Income		2,122.00
Annual Assessments		1,290.00
Admission Fees		170.00
Donation, R. C. Greenleaf		50.00
" J. Cummings		250.00
Lowell Institute Subsidy for Lectures		1,103.53
Publications		534.07
Total		$15,660.31
Ordinary Expenditures.		
Publications	$2,853.81	
Repairs of Museum	533.01	
Cabinet	1,808.50	
Library	623.78	
Fuel	399.00	
Gas	132.75	
Lectures	1,353.53	
Salaries	6,296.67	
General Expenses	1,410.45	$15,411.50
Excess of Receipts		$248.81
Extraordinary Expenditures.		
Museum and Furniture, additions and improvements		$10.689.01
Wyman Collection		5,000.00
		$15,689.01

E. Pickering, Treasurer,
Boston Society of Natural History.

Boston, May 1, 1875.

The Society then proceeded to the election of officers for the ensuing year. Messrs. L. L. Thaxter and A. E. Bouvé being appointed to collect and count the votes, announced the result as follows: —

PRESIDENT,
THOMAS T. BOUVÉ.

VICE-PRESIDENTS,
SAMUEL H. SCUDDER, JOHN CUMMINGS.

CORRESPONDING SECRETARY,
S. L. ABBOT, M.D.

RECORDING SECRETARY,
EDWARD BURGESS.

TREASURER,
EDWARD PICKERING.

LIBRARIAN,
EDWARD BURGESS.

CUSTODIAN,
ALPHEUS HYATT.

COMMITTEES ON DEPARTMENTS.

Minerals.

Thomas T. Bouvé,
L. S. Burbank,
R. H. Richards.

Geology.

Wm. H. Niles,
T. Sterry Hunt,
L. S. Burbank.

Palæontology.

Thos. T. Bouvé,
N. S. Shaler.

Botany.

John Cummings,
Charles J. Sprague,
J. Amory Lowell.

Microscopy.

Edwin Bicknell,
R. C. Greenleaf,
B. Joy Jeffries, M.D.

Comparative Anatomy.

Thomas Dwight, Jr., M.D.,
J. C. White, M.D.

Radiates, Crustaceans and Worms.

H. A. Hagen, M.D.,
Alexander E. Agassiz.

Mollusks.

Edward S. Morse,
J. Henry Blake,
Levi L. Thaxter.

Insects.

S. H. Scudder,
Edward Burgess,
A. S. Packard, Jr., M.D.

Fishes and Reptiles.

F. W. Putnam,
S. Kneeland, M.D.,
Richard Bliss, Jr.

Birds.

Thomas M. Brewer, M.D.,
Samuel Cabot, M.D.,
J. A. Allen.

Mammals.

J. A. Allen,
J. B. S. Jackson, M.D.

The following papers were read: —

On some of the Habits of the Blind Crawfish, Cambarus pellucidus, and the Reproduction of Lost Parts. By F. W. Putnam.

During the first half of the month of November last, I collected a number of the blind crawfish, *Cambarus pellucidus*, in the Mammoth Cave. Many of the specimens were brought alive to Massachusetts, and several still continue in good condition though they have eaten very little since their capture. I have several times offered them food in the shape of small bits of cooked meat and raw liver, crumbs of bread, etc., but, though they have generally carried the morsels to their jaws after long deliberation, they have, apparently, taken but a few mouthfuls, and, discarding the substances, have not touched them again.

The specimens of *Cambarus Bartonii*, the eyed crawfish, collected in the cave at the same time, on the contrary, are quite ready to eat and at once seize any food offered to them. The difference in the actions of the two species at such times is quite striking. The moment the water in its jar is disturbed the eyed species rears itself upon its tail, throws out its large claws, seizes the piece of meat, or bread, and hastily conveying it to its mouth, generally holds on to the morsel until it is all eaten, though sometimes this species will take but a bite or two and then drop the food, and I do not think it will touch the same piece again.

The blind species, on the contrary, darts backward as soon as the food is dropped into the water and then extends its antennæ and stands as if on the alert for danger. After a long while, sometimes from fifteen to thirty minutes, it will cautiously crawl about the jar with its antennæ extended as if using them for the purpose of detecting danger ahead. On approaching the piece of meat, and *before touching it*, the animal gives a powerful backward jump and remains quiet for a while. It then cautiously approaches again, and sometimes will go through this performance three or four times before it concludes to touch the article, and when it does touch it the result is another backward jump. After another quiet time it again approaches, perhaps only to jump back once more, but when it finally concludes that it is safe to continue in the vicinity of the meat, it feels with its antennæ for a while, and then takes the morsel in its claws and conveys it to its mouth. I have twice seen the meat dropped as it was passed along the base of the antennæ, as if the sense of smell, or more delicate organs of touch seated at that point, were again the cause of alarming the animal. When the jaws once begin to work, the piece of meat, or bread, if very small, is devoured, but if a little too large only a few bites are taken and the food is dropped and not again touched though the animal then crawls over it and rests upon it without being in the least concerned. These actions are best noticed by feeding with raw liver, and by not disturbing the crawfish for some days before. When bread is offered, the crawfish hardly has time to go through all his manœuvres before the bread becomes saturated and mixed with the water in small particles, some of which are eaten, but the most of them are left. If food is often presented, the crawfish, becoming accustomed to the disturbance, and probably to the smell, pays no attention to it.

The smallest of my living *C. Bartonii* cast its skin about February 20, but I had not noticed it for several days, and when observed it was engaged in eating its old skin, and had devoured about one half of it. The only observation made in this case was on the color of the animal. This little specimen was, when collected, of a light brown color, mottled with a darker shade; these markings are the same in its new skin, and, apparently, the animal has not increased in size. On January 29, it was noticed that one of the medium sized blind crawfish had left its old skin and seemed to be better provided with legs than before, as it had formerly suffered severely from being confined in the same jar with others. Indeed, about one half of my specimens were mutilated to a great extent by the terrible battles which they had with each other during the journey, when I was compelled to keep several in one jar, though they were in part protected from each other's fury by hiding under the moss placed in the jar for this purpose. This specimen was carefully observed, and a comparison made between its old and new skins. This individual was milk white when captured, and on coming out of its old skin it was of the same color, so that the theory that the grayish specimens are those that have recently shed their skins will not hold good.

The question now is, is color once attained by these animals ever lost or changed by their future growth? I have now, April 23, a living gray specimen with white tips to several of its claws, but as yet it has not favored me with a change of skin. As before mentioned, the young specimen of *C. Bartonii* has the same colors *after* shedding its shell as before, and this milk white *C. pellucidus* has not changed color after shedding its shell twice, and after living in full light of day, and often for hours in the sunshine, for over five months. On April 20, this same specimen cast its shell for the second time, and within three months of the time it last moulted. During this period it has not fed more than three or four times, and then only upon a small quantity of food.

The following gives the condition of the animal at the various periods of its existence since it has been in my possession.

November 13, captured the specimen, a female, in the waters of Mammoth Cave. It was perfect in all respects except the right, large claw, which was represented by a rudimentary one, entirely useless to the animal, and so small as to be almost imperceptible. Total length of the animal, when extended along a rule, and measuring from tip of large claw to end of tail, not quite two and one-half inches.

November 14 to 24. During this period the crawfish had several battles with the others in the same jar, and lost the larger part of her antennæ, the third, fourth and fifth legs from the left side, the fifth from the right side and the two end joints of the third leg on the right side.

January 28 and 29. On one of these days she cast her shell and came forth with a soft white covering, which was nearly two weeks in hardening. Then all the legs, or claws, that were perfect before were of the same size, but in addition the great claw of the right side was developed to about one-half or two-thirds the size of its fellow, and was apparently of as much use. The two missing joints of the third leg on the right side were also developed, though not quite to their full proportions. The fifth leg on the right side and the third, fourth and fifth of the left side, were now reproduced, but in a very small and rudimentary manner; all the joints were present, but every part was reduced in size. The antennæ were reproduced about two-thirds their full size. During the month of February the tips of the antennæ were accidentally broken, so as to reduce their length about one-third.

April 20. The old shell is cast whole, as before, and with her new dress the crawfish has also all her legs and claws nearly perfect.

The great claw of the right side is now very nearly as large as that of the left. The tip of the third leg of the same side is fully perfected, and all the legs that were rudimentary before are now developed, apparently to their full proportionate size, with the exception of the last on the right side, which is not quite perfect, the two terminal joints being somewhat rudimentary. The antennæ are reproduced, well formed, and of about their full length, though the one on the left side is not quite as long as the other.

From these observations it will be seen that the parts, such as the legs and antennæ, are not reproduced in perfection on one shedding of the shell, but that each time the shell is cast they are more nearly perfect than before, and that in this instance it has taken three moultings, one before the animal was captured, to bring the great claw nearly to its full size, and one more moulting, at least, will be necessary, in order to perfect this important member. The posterior legs, on the contrary, are perfected in two moultings, and in this case in about five months from the time they were lost. The antennæ are redeveloped more rapidly, and approach their full size in one moulting, and reproduce lost portions in less than three months. Since its capture the animal has not increased perceptibly in size, and on measurement to-day is still not quite two and one-half inches in length, measured as before.

It is also interesting to record that extremes of temperature do not affect these crawfish from the cave, as my several specimens have been a number of times retained for days in a heated room, and again have been exposed for weeks to such intense cold as to freeze the water in their jars.

Note. At the date of going to press, Aug. 7, 1875, all but two of the above mentioned specimens retained in my possession have died from various causes, principally due to neglect in changing the water in their jars. The female, *C. pellucidus*, mentioned as having shed her shell twice, died June 10, without doing anything worthy of further note. Another specimen of the blind species, of about the same size, is still alive, and has been exposed to the full light of day since last November, has eaten but very little, and has not shed its shell. The small specimen of *C. Bartonii*, mentioned above as having moulted, has not increased in size nor changed in color since February, and is apparently in good condition.

Synopsis of the Odonata of America. By Dr. H. A. Hagen.

Since the publication of my Synopsis by the Smithsonian Institution, in July, 1861, I have endeavored to prepare a new and more complete edition. The material contained in American collections has been carefully studied and compared with that in my collection, as a preparation for a complete monograph with detailed descriptions and plates. At present its publication is impossible, but I think that a complete list of all species hitherto described or known to me may help students considerably, as a few works contain nearly all the descriptions, and are in the hands of every one interested in the study of the Odonata. There are a few species given only by names, but the descriptions of these are ready, some even have been so for years, and will be published at an early date. The list of localities will be found augmented very considerably, chiefly for North American species. As in my former work, I give South American species in a separate list, and all others, including those from Central America, Mexico and the West Indian Archipelago, together in the list of the species of North America. This is done, of course, for convenience, and because that the larger part of the species of Central America, Mexico, and the West Indian Islands are to be found in Texas and in the southern parts of the United States, chiefly in Florida, some as far north as Georgia.

The synonomy is given as completely as possible. The opportunity to study several types of Thomas Say in Harris's collection, and the types of S. H. Scudder and Ph. R. Uhler, has been granted to me, and has much assisted my work.

Four hundred and eighty species are now enumerated, instead of three hundred and sixty-seven in the former work. The subfamily of the Agrionina has been omitted, as the Synopsis of the subfamily by Baron De Selys Longchamps is in the way of publication.

Subfamily CALOPTERYGINA.

Calopteryx.

1. Calopteryx angustipennis, ♂, ♀.

Sylphis angustipennis Selys! Monogr., 21, 2; Syn., 9, 2.—Walk. Cat., 590, 2. — Hag.! Syn., 56, 1; Stett. Z., XXIV, 372, 24; Proc. Bost. Soc. Nat. Hist., 363, 51.

Sylphis elegans Selys! Monogr., 20, 1, pl. 2, f. 1; Syn. 9, 1.—Walk. Cat., 590, 1.

Hab. Briar Creek, Georgia, April 18; Bee Spring, Kentucky, June.

Of this rare species only three specimens are known; the male (*C. angustipennis*) from Abbot, in the British Museum, figured by Abbot; an immature and imperfect female specimen (*C. elegans*), locality not known, and an adult female from Kentucky in my collection. The difference quoted in Selys' Monogr., p. 21, in the direction of the principal sector, was found, after a repeated examination of the male type in the British Museum, not to exist.

2. Calopteryx apicalis, ♂, ♀.

Calopteryx apicalis Burm.! Handb., II, 827, 8. — Selys! Monogr., 23, 3; Syn., 9, 3. — Walk. Cat., 591, 3. — Hag.! Syn., 56, 2.

Hab. Philadelphia, Pennsylvania.

The locality Massachusetts in my Synopsis, p. 57, was given by Mr. Uhler. I have seen two females, Waltham, July 21, but each of them possesses a very small white pterostigma; one male, partly broken, from the same locality; probably they belong to this species.

3. Calopteryx dimidiata, ♂, ♀.

Calopteryx dimidiata Burm.! Handb., II, 826, 16.— Selys! Monogr., 24, 4; Syn., 10, 4. — Walk. Cat., 591, 4. — Hag.! Syn., 57, 3; Stett. Z., XXIV, 372, 25; Proc. Bost. Soc. Nat. Hist., XVI, 364, 52.

Calopteryx cognata Rbr.! Neur., 222, 6.

Calopteryx Syriaca Rbr.! Neur., 223, 9. (In part; male.)

Hab. Kentucky; Georgia; Palatka, St. Johns River, Florida, March.

4. Calopteryx æquabilis, ♂, ♀.

Calopteryx æquabilis Say! Journ. Acad. Philad., VIII, 33, 2.—Hag.! Proc. Bost. Soc. Nat. Hist., XV, 274, 40.

Agrion fugitiva Harris! Cat. Hitchcock Rep., Edit. II, 581.

Agrion æquabilis Harris! Cat. Hitchcock Rep., Edit. II, 581.

Hab. Norway, Maine; Brookline, Tyngsboro, Mass.; probably Rock Island, Ill.; probably Georgia; the males in the British Museum quoted as *C. virginica* in Selys' Monogr., 31.

With the *C. virginica* Selys, Monogr., 29, 6, Syn., 11, 6, Walk. Cat., 592, 6, Hag. Syn., 58, 5, probably are mixed together three different species, viz.: *C. maculata*, *C. æquabilis*, and a new one from Hudson's Bay.

C. virginica Drury, I, 113, 2, pl. 48, 2, a female from Virginia, surely belongs neither to *C. æquabilis* nor to the species from Hudson's Bay. The large dimensions of Drury's figure, which prevented De Selys from recognizing it as *C. maculata*, are equalled by some females from Texas and Kentucky; the length of the wings only 36 millim., instead of 37 millim. in Drury's figure. Drury's coloration and description makes it doubtless that his species is *C. maculata.*

The males from Georgia, described as *C. virginica* in Selys' Monogr., belong probably to *C. æquabilis.* The female from Hudson's Bay, *C. virginica* Selys' Monogr., belongs to *C. hudsonica.* In the Proc. Bost. Soc. Nat. Hist., XV, 274, I considered both species to be identical, but I had not seen at that time females of *C. æquabilis*, and only a female and two imperfect young males of *C. hudsonica.*

5. Calopteryx hudsonica, ♂, ♀.

Calopteryx virginica Selys, Monogr., 29, 6 (in part; the female); Syn., 11, 6. — Hag. Syn., 58, 5 (in part; female); Proc. Bost. Soc. Nat. Hist., XV, 274, 40.

Hab. Hudson's Bay Territory; Michipicoten, Lake Superior, British America.

6. Calopteryx maculata, ♂, ♀.

Agrion maculata Beauv., 85, pl. 7, f. 3.

Calopteryx maculata Burm ! Handb., II, 829, 17. — Selys! Monogr., 27, 5; Syn., 10, 5.—Walk.! Cat., 592, 5.— Hag.! Syn., 57, 4; Stett., Z., XXIV, 372, 26; Proc. Bost. Soc. Nat. Hist., XV, 274, 40; ibid., XVI, 364, 53.

Calopteryx holosericea Burm.! Handb., II, 828, 13.— Ramb., Neur., 226, 14.

Calopteryx papilionacea Rbr.! Neur., 222, 6.

Calopteryx opaca Say! Journ. Acad. Philad., VIII, 32, 2.

Calopteryx materna Say, Journ. Acad. Philad., VIII, 32, 1.

Calopteryx virginica Drury, I, 113, 3, pl. 42, f. 2, fem.

Hab. Massachusetts; Maine, in June; New York; Pennsylvania; Maryland; Washington, D. C.; S. Carolina; Georgia; Florida; Kentucky, in May, June; Texas; Kansas; Ohio; Illinois; Upper Wisconsin River; Ontario, Canada.

C. holosericea Burm.! is a male, labelled Java, and from the Leiden Museum I possess a female labelled Java. Both labels are probably erroneous.

7. Calopteryx splendens.

Calopteryx splendens Hag. Syn., 58, 6. — Selys, Monogr., 274.

Hab. A male in the Zuerich Museum is labelled Georgia, Abbott; probably erroneous.

Calopteryx virgo Fab, Faun. Grœnl., 196, 152, probably erroneous; according to Schioedte, Berl. Zeit., III, 142, it has not been rediscovered there.

HETÆRINA.

1. Hetærina septentrionalis, ♂.

Hetærina septentrionalis Selys! Monogr., 119, 43, pl. 11, f. 6; Syn., 119, 43.—Walk. Cat., 622, 16.—Hag. Syn., 59, 1; Stett. Z., XXIV 372, 29.

Hab. Georgia. Only the typical male is known.

2. Hetærina Californica, ♂, ♀.

Hetærina Californica Selys! Syn. Addit., I, 6, 49 bis; Addit., III, 16, 49 bis.—Hag. Syn., 59, 2.

Hab. River Slawianka, Northern California; Yellowstone, Montana. Three males identical. Is it a race of *H. basalis* Hag.?

3. Hetærina cruentata, ♂, ♀.

Calopteryx cruentata Ramb.! Neur., 228, 19, male.

Hetærina cruentata Selys! Monogr., 127, 48, pl. 12, f. 1; Syn., 39, 48.—Walk. Cat., 625, 31.—Hag.! Syn., 59, 3.

Calopteryx luteola Rbr., Neur., 223, 8, fem.

Hab. Mexico; Martinique; Venezuela; Surinam; Brazil.

4. Hetærina vulnerata, ♂, ♀.

Hetærina vulnerata Selys! Monogr., 130, 49, pl. 12, f. 2; Syn., 40, 49.—Walk. Cat., 626, 22.—Hag.! Syn., 60, 4.

Hab. Mexico; Columbia; Brazil.

5. Hetærina americana, ♂, ♀.

Agrion americana Fabr.! Ent. Syst. Suppl., 287, 3–4.

Calopteryx americana Burm.! Handb., II, 826, 4.—Ramb., Neur., 227, 18.

Hetærina americana Selys! Monogr., 131, 50, pl. 12, f. 3; Syn., 41, 50.—Walk. Cat., 627, 23.—Hag.! Syn., 60, 5; Proc. Bost. Soc. Nat Hist., XV, 274, 41.

Lestes basalis Say, Journ. Acad. Philad., VIII, 35, 2.

Agrion basalis and *insipiens* Harris! Cat. Hitchcock Rep., Ed. II, 581.

Hetærina pseudamericana Walsh! Proc. Ent. Soc. Philad., I, 223.

Hab. Weston, Mass., September 8; Norway, Maine; Maryland; Washington, D. C.; Missouri; Indiana; Rock Island, Illinois, July–August; Upper Wisconsin River.

6. Hetærina scelerata, ♂.

Hetærina scelerata Walsh, Proc. Ent. Soc. Philad., I, 267.

Hab. Rock Island, Illinois, July. Unknown to me.

Referred by Selys, Syn. Addit., III, 49, to *H. basalis* and *H. californica.*

7. Hetærina texana, ♂, ♀.

Hetærina texana Walsh! Proc. Ent. Soc. Philad., I, 227.

Hetærina basalis Hag.! Syn., 60, 6.

Hab. Pecos River, Western Texas, June–August; Waco, Texas, September; Cordova, Atlihnazen, Portrero, Mexico.

In Selys' Syn. Addit., III, 49, this species is referred to *H. americana*, but Walsh's type was from just the same lot as mine, and there is no doubt about the identity.

8. Hetærina tricolor, ♂, ♀.

Calopteryx tricolor Burm.! Handb., II, 827, 7.

Hetærina tricolor Selys! Monogr., 136, 52, pl. 12, f. 5; Syn., 42, 52.—Walk. Cat., 629, 25.—Hag. Syn.! 61, 7; Stett. Ent. Z., XXIV, 372, 30; Proc. Bost. Soc. Nat. Hist., XVI, 364, 55.

Hab. Philadelphia, Pa.; Georgia.

9. Hetærina limbata, ♂, ♀.

Hetærina limbata Selys, Syn., 43, 52; Monogr. 137; Syn. Addit., III, 49.

Hetærina rupamnensis Walsh! Proc. Ent. Soc. Philad., I, 230.

Hetærina rupinsulensis ? Walsh, Proc. Acad. Philad., 1862, 383.

Hab. Georgia; Rock Island, Ill., July; Waco, Texas, September.

10. Hetærina Titia, ♂, ♀.

Libellula Titia Drury, II, 83, pl. 45, f. 3.

Calopteryx Titia Burm., Handb., II, 826, 3.—Ramb., Neur., 227. 17.

Hetærina Titia Selys! Monogr., 138, 53; Syn., 43, 53; Walk. Cat., 43, 53.—Hag.! Syn., 61, 8.

Hab. Honduras; Mexico; Waco, Texas, September 9.

11. Hetærina bipartita, ♂.

Hetærina Titia, race *bipartita* Selys, Syn. Addit. III, 17, 53.

Hab. Chontales, Nicaragua; St. Antonio, Texas.

12. Hetærina sempronia, ♂, ♀.

Hetærina sempronia Selys! Monogr., 147, 56, pl. 12, f. 7; Syn., 45, 56; Addit., III, 18, 56.—Walk. Cat., 632, 29.—Hag. Syn.! 62, 10.

Hab. Mexico, Putla, Vera Cruz; Bogota; probably St. Antonio, Texas.

13. Hetærina macropus, ♂, ♀.

Hetærina macropus Selys! Monogr., 141, 54; Syn., 44, 54; Addit., III, 17, 44. — Walk. Cat., 631, 27. — Hag. Syn.! 62, 9.

Hab. Acapulco, Mexico.

In Selys' Syn. Addit., III, 49, *H. macropus* is considered a variety of *H. occisa*. I believe them distinct.

Cora.

1. Cora marina, ♂.

Cora marina Selys, Ann. Soc. Ent., Belg., XI, Proc., 69, 7; Syn. Addit., II, 34, 100 ter.

Hab. Orizaba, Mexico. Unknown to me.

Calopterygina of South America.

Lais.

1. Lais globifer, ♂, ♀.

Lais globifer Selys! Monogr., 88, 28, pl. 10, f. 1; Syn., 27, 28.— Walk. Cat., 613, 1. — Hag. Syn.! 305.

Hab. New Fribourg, Brazil.

2. Lais guttifera, ♂, ♀.

Lais guttifera Selys! Syn. Addit., III, 12, 33 bis.

Hab. S. Joao del Rey, Brazil, November.

3. Lais smaragdina, ♂, ♀.

Lais smaragdina Selys, Syn. Addit., II, 8, 29 bis.

Hab. Santarem, Amazon. Unknown to me.

4. Lais ænea, ♂, ♀.

Lais ænea Selys! Monogr., 91, 29, pl. 10, f. 2; Syn., 28, 29; Addit., II, 8, 29. — Hag. Syn.! 305.

Hab. Para, Santarem, Amazon and Tapajos Rivers, Brazil.

5. Lais cuprea, ♂, ♀.

Lais cuprea Selys! Monogr., 92, 30; Syn., 28, 30; Addit., II, 9, 30.— Walk. Cat., 613, 3. — Hag. Syn.! 305.

Hab. Para, S. Paulo and Fonte Bon, Peba, Upper Amazon.

6. Lais Hauxwelli, ♂, ♀.

Lais Hauxwelli Selys, Syn. Addit., II, 10, 30 bis; Addit., III, 12, 30 bis.

Hab. Peba, Upper Amazon. Unknown to me.

7. Lais metallica, ♂, ♀.

Lais metallica Selys, Syn. Addit., II, 10, 31 bis.

Hab. Bahia or Guyana, probably. Unknown to me.

8. Lais hyalina.

Lais hyalina Selys! Monogr., 92, 31; Syn., 28, 31; Addit., III, 13, 30.

Hab. Teresopolis, S. Jose de Picu, Brazil, November.

9. Lais pruinosa, ♂, ♀.

Lais pruinosa Selys! Monogr., 93, 32, pl. 10, f. 3; Syn., 28, 32.—Walk. Cat., 615, 5. — Hag. Syn.! 305.

Hab. Brazil.

10. Lais pudica, ♂, ♀.

Lais pudica Selys! Monogr., 95, 33, pl. 10, f. 4; Syn., 29, 33.—Walk. Cat., 615, 6. — Hag. Syn.! 305.

Hab. Ypanema, Brazil.

HETÆRINA.

1. Hetærina duplex, ♂, ♀.

Hetærina duplex Selys! 12, 34 ter. — Hag.! Stett. Z., XXX, 256, 1.

Hab. Bogota, New Grenada.

2. Hetærina simplex, ♂, ♀.

Hetærina simplex Selys! Monogr., 98, 34, pl. 10, f. 5; Syn., 30, 34.—Walk. Cat., 616, 7.— Hag. Syn., 305.

Hetærina perplex Selys, Syn. Addit., II, 11, 34 bis.

Hab. Minas Jeraes; Para, Brazil.

3. Hetærina sanguinea, ♂, ♀.

Hetærina sanguinea Selys! Monogr., 100, 35, pl. 10, f. 6; Syn. 31, 35; Addit., III, 14, 35. — Walk. Cat., 617, 8. — Hag. Syn., 305.

Hab. Para; Cupari, Ega, S. Paulo, Upper Amazon.

4. Hetærina rosea, ♂, ♀.

Hetærina rosea Selys! Monogr., 102, 36, pl. 10, f. 7 ; Syn., 31, 36.—Walk. Cat., 617, 9. — Hag. Syn.! 305.

Hab. Minas Jeraes, Brazil.

5. Hetærina Caja, ♂, ♀.

Libellula Caja Drury, II, 82, pl. 44, f. 2.

Calopteryx Caja Burm.! Handb., II, 826, 5 (in part).

Hetærina Caja Selys! Monogr., 104, 37, pl. 10, f. 8 ; Syn , 32, 37.—Walk. Cat., 618, 10. — Hag. Syn. ! 305.

Hab. Columbia ; Porto Cabello, Venezuela.

6. Hetærina Dominula, ♂, ♀.

Calopteryx Caja Erichs! Schomburgh Reise, III. — Ramb. Neur.! 226, 16 (in part).

Hetærina Dominula Selys! Monogr., 197, 38, pl. 11, f. 1; Syn. 33, 38.—Walk. Cat., 619, 11.— Hag. Syn.! 305.

Hab. Guiana; Surinam; Brazil.

7. Hetærina Donna, ♂, ♀.

Hetærina Donna Selys, Syn. Addit., III, 14, 36 ter.

Hab. St. Teresa, Enterios, September; Juiz de Fora, November, Brazil. Unknown to me.

Perhaps *H. Caja*, *Donna* and *rosea*, are but races of the same species.

8. Hetærina auripennis, ♂, ♀.

Calopteryx auripennis Burm.! Handb., II, 827, 10.— Ramb. Neur., 225, 13.

Calopteryx Caja Ramb.! Neur., 226, 16 (in part).

Hetærina auripennis Selys! Monogr., 109, 39, pl. 11, f. 2; Syn., 33, 39.— Walk. Cat., 619, 12.—Hag. Syn.! 305.

Hab. Bahia, Rio, Brazil.

9. Hetærina Hebe, ♂, ♀.

Hetærina Hebe Selys! Monogr., 112, 40, pl. 11, f. 3; Syn., 34, 40.— Walk. Cat., 620, 13.— Hag. Syn.! 306.

Calopteryx Caja Burm.! Handb., II, 826, 5 (in part).

Hab. Brazil.

10. Hetærina sanguineolenta, ♂, ♀.

Hetærina sanguineolenta Selys! Monogr., 115, 41, pl. 11, f. 4; Syn., 35, 41.— Walk. Cat., 621, 14.—Hag. Syn.! 621, 14.

Hab. Bahia, Brazil.

11. Hetærina mortua, ♂.

Hetærina mortua Selys! Monogr., 117, 42, pl. 11, f. 5; Syn., 35, 42.—Walk. Cat., 621, 15.— Hag. Syn.! 306.

Hab. Guiana.

12. Hetærina læsa, ♂, ♀.

Hetærina læsa Selys! Monogr., 119, 44; Syn., 36, 44.—Walk. Cat., 622, 17.— Hag. Syn.! 306.

Hab. Surinam.

13. Hetærina carnifex, ♂, ♀.

Hetærina carnifex Selys! Monogr., 123, 46, pl. 11, f. 8; Syn., 37, 46; Addit., III, 15, 46.—Walk. Cat., 624, 19.— Hag. Syn.! 306.

Hab. New Friburg, Minas Geraes, Brazil; Quito, Ecuador.

Race, *H. fulgens* Selys!; ibid., Hab., Minas Geraes.

14. Hetærina longipes, ♂, ♀.

Hetærina longipes Selys! Monogr., 121, 45, pl. 11, f. 7; Syn., 37, 45; Addit., III, 15, 46; Walk. Cat., 623, 18.— Hag. Syn.! 306.

Hab. Brazil. Supposed to be a race of *H. carnifex* by Selys, Syn. Addit., III, 15, 46.

15. Hetærina proxima, ♂, ♀.

Hetærina proxima Selys! Monogr., 125, 47, pl. 11, f. 9; Syn. 38, 47; Addit., III, 15, 46. — Walk. Cat., 624, 20. — Hag. Syn.! 306.

Calopteryx Caja Ramb.! Neur., 226, 16 (in part).

Hab. Ypanema, Brazil.

Supposed to be a race of *H. carnifex* by Selys, Syn., Addit., III, 15, 46.

16. Hetærina cruentata, ♂, ♀. (cf. N. America.)

Hetærina cruentata Hag.! Stett. Z., XXX, 256, 2.

Race *H. Brasiliensis* Selys! Monogr., 129.

Hab. Paranas de St. Urban; Venezuela; Surinam; Bogota, N. Granada; Columbia; N. America.

17. Hetærina vulnerata, ♂, ♀. (cf. N. America.)

Hab. Brazil; Columbia; N. America.

18. Hetærina Americana, ♂, ♀. (cf. N. America.)

Hab. Brazil; perhaps erroneously labelled.

19. Hetærina moribunda, ♂, ♀.

Hetærina moribunda Selys! Monogr, 134, 54, pl. 12, f. 4; Syn., 42, 51.— Walk. Cat., 628, 24. — Hag. Syn.! 306.

Hab. Cayenne; Para, Brazil.

20. Hetærina occisa, ♂, ♀.

Hetærina occisa Selys! Monogr., 143, 55, pl. 12, f. 6; Syn., 44, 55; Addit., III, 17, 55. —Walk. Cat., 631, 28.—Hag. Syn.! 306; Stett. Z., 257, 3.

Race, *H. albistigma*, female, Selys! Monogr., 146.

Hab. Columbia; Porto Cabello, Laguayra, Paranas de St. Urban, Bogota.

H. macropus and *H. asticta* are believed to be a race in Selys' Syn. Addit., III, 17.

21. Hetærina Brightwelli, ♂, ♀.

Agrion Brightwelli Kirby, Trans. Linn. Soc., XIV, 107, pl. 3, f. 5.

Calopteryx Brightwelli Burm., Handb., II, 826, 5.

Calopteryx Caja Ramb.! Neur., 226, 16 (in part).

Hetærina Brightwelli Selys! Monogr., 148, 57, pl. 12, f. 8; Syn., 46, 57. — Walk. Cat., 633, 30. — Hag. Syn.! 306.

Hab. New Fribourg, Rio, Irisanga, Brazil.

22. Hetærina majuscula, ♂, ♀.

Hetærina majuscula Selys! Monogr., 151, 58, pl. 13, f. 1; Syn., 47, 58 ; Addit., III, 18, 50. — Walk. Cat., 634, 31. — Hag. Syn.! 306; Stett. Z., XXX, 257, 4.

Hetærina capitalis Selys, Syn., Addit., III, 18, 58 bis.

Hab. Surinam; Columbia; Bogota, N. Granada.

H. capitalis is perhaps a race of *H. majuscula.*

23. Hetærina Borchgravii, ♂, ♀.

Hetærina Borchgravii Selys! Syn. Addit., II, 14, 47 bis.

Hab. Tijuca, near Rio, Brazil.

HELIOCHARIS.

1. Heliocharis Amazona, ♂.

Heliocharis Amazona Selys! Monogr., 188, 1, pl. 5, f. 5; pl. 14, f. 5; Syn., 55, 71; Addit., II, 17, 71. — Walk. Cat., 642, 1. — Hag. Syn.! 306.

Hab. Ega, Amazon; Para.

? Race, *Heliocharis libera*, ♂, ♀, Selys, Syn., Addit., II, 17, 70 ter; Hab., Para.

2. Heliocharis Brasiliensis Selys! Syn. Addit., I, 9, 71 bis. — Hag. Syn.! 306.

Hab. Bahia.

DICTERIAS.

1. Dicterias atrosanguinea, ♂, ♀.

Dicterias atrosanguinea Selys! Monogr., 191, 72, pl. 5, f. 6; pl. 8, f. 12; pl. 14, f. 6; Syn., 56, 72; Addit., II, 18, 72. — Walk. Cat., 643, 2. — Hag. Syn.! 307.

Hab. Santarem, Amazon.

Dicterias procera Hag.! Syn., 307; Selys, Syn. Addit., I, 10, 72 bis.; Addit., III, 51; is supposed to be a race of *Heliocharis Amazona.* Hab., Santarem.

AMPHIPTERYX.

1. Amphipteryx agrioides, ♀.

Amphipteryx agrioides Selys! Monogr., 241, 92, pl. 6, f. 5; pl. 8, f. 15; Syn., 66, 1; Addit., I, 16. — Walk. Cat., 654, 1. — Hag. Syn.! 307.

Hab. Columbia.

CHALCOPTERYX.

1. Chalcopteryx rutilans, ♂, ♀.

Rhinocypha rutilans Ramb.! Neur., 233, 1.

Chalcopteryx rutilans Selys! Monogr., 251, 94, pl. 7, f. 1, 2; pl. 9,

f. 7; Syn. 68, 94; Addit., II, 25, 94; Addit., III, 32.—Walk. Cat., 655, 1.—Hag. Syn.! 307.

Hab. Para, Santarem, Brazil.

2. Chalcopteryx scintillans, ♂.

Chalcopteryx scintillans Selys, Syn., Addit., III, 32, 94 ter.

Hab. S. Paulo, Upper Amazon. Unknown to me.

Thore.

1. Thore Victoria, ♂, ♀.

Thore Victoria M'Lachl., Entom. monthl. Mag., VI, 28.—Selys, Syn., Addit., II, 25, 94 bis; Addit., III, 33, 94 bis.

Hab. Bolivia. Unknown to me.

2. Thore gigantea, ♂, ♀.

Thore gigantea Selys! Monogr., 254, 1, pl. 7, f. 3; Syn., 69, 95; Addit., II, 26, 95; Addit., III, 34, 95.—Walk. Cat., 656, 2.—Hag. Syn.! 307.

Thore picta Hag.! Stett. Z., 257, 5.

Hab. Bogota, Columbia; Chimborazo; Rio Negro and Rio Grande, Upper Amazon, Ecuador.

Race, *Thore procera* Selys! Syn., Addit., II, 27, 95 bis. Hab.; Bogota.

? Race, *Thore picturata* Selys, Syn. Addit., III, 35, 97 bis. Hab., Cayenne. *Th. picturata* is regarded Addit., III, 35, as a race of *Th. Saundersii*, and ibid., p. 54, as probably a race of *Th. gigantea.*

3. Thore Saundersii, ♂, ♀.

Thore Saundersii Selys! Monogr., 256, 96; Syn., 70, 96; Addit., II, 27, 97; Addit., III, 36, 97.—Walk. Cat., 657, 4.—Hag. Syn.! 307.

Hab. Para; Peba, Upper Amazon; Ecuador.

4. Thore picta, ♂, ♀.

Euphaea picta Ramb.! Neur., 231, 4.

Thore picta Selys! Monogr., 256, 96; Syn., 70, 96; Addit., II, 28, 96; Addit., III, 36, 97 sext.

Hab. Cayenne; Para; Ega, Upper Amazon; Ecuador; Bogota, New Granada.

Race, *Th. vittata* Selys, Syn. Addit., II, 29, 96 bis. Hab., Ega.

Race. *Th. æquatorialis* Selys, Syn. Addit., III, 36, 87 sext. Hab., Ecuador.

5. Thore Batesi, ♂, ♀.

Thore Batesi Selys! Syn., Addit., II, 29, 96 ter.

Race, *Th. inæqualis* Selys, Syn. Addit., II, 30, 96 bis.

Hab. S. Paulo, Fonte Boa, Upper Amazon.

6. Thore beata, ♂, ♀.

Thore beata M'Lachl.! Ent. monthl. Mag., VI, 28. — Selys, Syn. Addit., II, 30, 96 quint.

Hab. Peba, Upper Amazon.

7. Thore fasciata, ♂, ♀.

Thore fasciata Selys! Monogr., 259, 98, pl. 8, f. 16; pl. 9, f. 8; Syn., 70, 98; Addit., II, 32, 98. — Walk. Cat., 637, 5. — Hag. Syn.! 307; Stett. Z., XXX, 259, 6.

Race, *Th. plagiata* Selys, Syn. Addit., III, 37, 98 bis.

Hab. Columbia; Porto Cabello, Venezuela; Rio Negro, Amazon; Bogota, N. Granada.

8. Thore fastigiata, ♂.

Thore fastigiata Selys! Syn. Addit., I, 99 bis; Addit., II, 33, 99 bis. — Hag.! Stett. Z., XXX, 259, 8.

Hab. Bogota, Columbia.

9. Thore hyalina, ♂, ♀.

Thore hyalina Selys! Monogr., 261, 99, pl. 7, f. 4; Syn., 71, 99; Addit., II, 33, 99; Addit., III, 38, 99. — Walk. Cat., 658, 8. — Hag. Syn.! 307; Stett. Z., XXX, 259, 7.

Hab. Bahia, Brazil; Bogota, Columbia.

Cora.

1. Cora cyane, ♂.

Cora cyane Selys! Monogr., 263, 100, pl. 7, f. 5; Syn., 71, 100; Addit., II, 35, 100.

Hab. Porto Cabello, Venezuela.

Race? *Cora incana* Selys! Syn. Addit., II, 35, 100, quart.

2. Cora brasiliensis, ♂, ♀.

Cora brasiliensis Selys! Syn. Addit., II, 34, 100 bis.

Hab. Brazil.

3. Cora Alcyone, ♂.

Cora Alcyone Selys, Syn. Addit., III, 39, 100 sext.

Hab. Bogota. Unknown to me.

4. Cora Inca, ♂, ♀.

Cora Inca Selys, Syn. Addit., III, 39, 100, sept.

Hab. Quito, Ecuador. Probably *C. brasiliensis*.

5. Cora modesta, ♂, ♀.

Cora modesta Selys, Syn. Addit., II, 36, 100 quint; Addit., III, 40, 100 quint.

Hab. Bogota.

Subfamily ÆSCHNINA.

Anax.

1. Anax Junius, ♂, ♀.

Libellula Junia Drury, Ins., I, 112, pl. 47, f. 5.

Æschna Junia Burm.! Handb., II, 841, 18. — Say, Journ. Acad. Philad., VIII, 10, 2. — Ramb. Neur., 196, 6.

Anax spiniferus Ramb.! Neur., 186, 4, pl. 1, f. 14.

Anax Junius Selys! Revue des Odon., 328; Sagra Ins., Cuba, 458.—Hag.! Syn., 118, 1; Verhdl. Wien Z. B. G., XVII, 33; Stett. Z., XXIV, 373, 51.— Proc. Bost. Soc. Nat. Hist., XI, 291; XV, 271, 28; XVI, 350, 1. — Walsh! Proc. Acad. Philad., 1862, 397. — Brauer, Voy. Novara, 61, 10.

Hab. Massachusetts; N. York; N. Jersey; Maryland; Kentucky; S. Carolina; Georgia, March, April; Florida; Louisiana; Missouri; Illinois; Detroit, Michigan; Dallas, Waco, Texas, May; Pecos River, Texas, July, August; Matamoras, Mexico; S. Francisco, California; Cuba; Kamschatka; Petcheli Bay, China, April; Oahu, Sandwich Islands.

2. Anax longipes, ♀.

Anax longipes Hag.! Syn., 118, 2; Stett. Z., XXIV, 373, 52; Proc. Bost. Soc. Nat. Hist., XVI, 350, 2; Verhdl. Wien Z. B. G., XVII, 35. — Brauer, Voy. Novara, 60, 3.

Hab. Georgia.

I have only seen one female in the Museum in Zuerich; Mr. M'Lachlan assured me, 1873, that the male was discovered, proving that *A. longipes* is a good species.

3. Anax validus, ♂, ♀.

Anax validus Hag.! (No description.)

Hab. San Diego, California, April.

4. Anax Amazili, ♂, ♀.

Æschna Amazali Burm.! Handb., II, 841, 19.

Anax maculatus Ramb.! Neur., 188, 7.

Anax Amazili Hag.! Syn., 119, 3; Verhdl. Wien. Z. B. G., XVII, 38. — Brauer, Voy. Novara, 61, 9.

Hab. Guatemala; Cuba; Barbados; Porto Cabello, Venezuela; Amazon, Para, Pernambuco, Rio, Brazil.

Gomphæschna.

1. **Gomphæschna furcillata,** ♂, ♀.

Æschna furcillata Say! Journ. Acad. Philad., VIII, 15, 7. — Hag.! Syn., 131, 25.

Gynacantha quadrifida Ramb.! Neur., 209, 1.

Gomphœschna furcillata Hag.! Proc. Bost. Soc. Nat. Hist., XV, 272, 33; XVI, 351, 7.

Hab. Massachusetts, Sutton, June 15; Milton, Brookline, Mass., June 8; Manchester, Mass., July 4; Detroit, Michigan; Georgia.

2. **Gomphæschna Antilope,** ♂, ♀.

Æschna Antilope Hag.! Proc. Bost. Soc. Nat. Hist., XVI, 354, 8.

Hab. Druid Hill, Baltimore, Md.

Æschna.

1. **Æschna Janata,** ♂, ♀.

Æschna Janata Say! Journ. Acad. Philad., VIII, 13, 6. — Hag., Syn., 125, 11; Stett. Z., XXIV, 373, 54.—Proc. Bost. Soc. Nat. Hist., XV, 271, 32; ibid, XVI, 356, 9.

Æschna minor Rbr., Neur., 207, 20.

Hab. Milton, Mass., May 10, June; Roxbury, Mass.; Carver Woods, Mass., May 28; White Mountains, N. Hampshire. Very rare.

2. **Æschna sitchensis,** ♂.

Æschna sitchensis Hag.! Syn., 119, 1.

Hab. Sitka, Alaska.

I have only seen one male; this species differs from *Æ. borealis.*

3. **Æschna septentrionalis,** ♂, ♀.

Æschna septentrionalis Burm.! Handb., II, 839, 11. — Hag.! Syn., 120, 2.

Hab. Nova Scotia; Hopedale, Labrador; Fort Resolution, Great Slave Lake; Saskatchewan, British America; White Mountains, N. Hampshire.

4. **Æschna californica,** ♂, ♀. (Hag., no description.)

Hab. Gulf of Georgia, S. Mateo, Cal.; British Columbia.

5. **Æschna multicolor,** ♂, ♀.

Æschna multicolor Hag.! Syn., 121, 4; Hayden, Rep., 1872, 727; 1873, 591.

Hab. Pecos River, West Texas, July, August; Cordova, Mexico; Upper Missouri River; Yellowstone; Victoria, Vancouver's Island, July.

6. **Æschna constricta,** ♂, ♀.

Æschna constricta Say, Journ. Acad. Philad., VIII, 11, 3. — Hag.! Syn., 123, 8; Proc. Bost. Soc. Nat. Hist., XV, 271, 31; 376, 2; Hayden, Rep., 1872, 727; Rep., 1873, 591.—Walsh! Proc. Acad. Philad., 1862, 397. — Scudder! Proc. Bost. Soc. Nat. Hist., X, 212.

Æschna contorta Hag.! Syn., 126, 14.

Æschna palmata Hag.! Stett. Z., XVII, 369. — Selys, Ann. Soc. Ent., XVII, 34, male.

Æschna arundinacea Selys, Ann. Soc. Ent., XVII, 36, female?

Hab. Nova Scotia; Maine; New Hampshire, White Mountains, August; Massachusetts; Connecticut; New York, September; Pennsylvania; Maryland; Missouri; Indiana; Illinois; Yellowstone, Colorado; British Columbia; Labrador; Kamtschatka, Irkutsk, Wilui River, Asia.

Æschna palmata was formerly described as a different species; but now I know American specimens with similar small numbers of anticubitals. The bands on the thorax have been present, perhaps narrower. The legs, at least the anterior, are above rufous on the femur.

7. **Æschna armata,** ♂, ♀.

Æschna armata Hag.! Syn., 124, 9.

Hab. Trojés del Oro, Mexico.

8. **Æschna eremitica,** ♂, ♀.

Æschna eremitica Scudder! Proc. Bost. Soc. Nat. Hist., XI, 213. — Hag.! Proc. Bost. Soc. Nat. Hist., XI, 294; XV, 376, 3.

Æschna crenata Hag.! Stett. Z., XVII, 369; XIX, 97.— Selys, Ann. Soc. Ent., XVII, 135.

Hab. White Mountains, New Hampshire, August; Fort Resolution, Great Slave Lake, Saskatchewan, British America; Labrador; Irkutsk; Wilui River.

The black anterior line on the front is sometimes wanting.

9. **Æschna verticalis,** ♂, ♀.

Æschna verticalis Hag.! Syn., 122, 6.

Æschna clepsydra Walsh! Proc. Acad. Philad., 1862, 397.

Æschna propinqua Scudd.! Proc. Bost. Soc. Nat. Hist., X, 214. (Male, in part.)

Hab. New York; Washington, D. C.; Maine; N. Hampshire; Illinois; Canada; Massachusetts, August.

10. Æschna clepsydra, ♂, ♀.

Æschna clepsydra Say! Journ. Acad. Philad., VIII, 12, 4. — Hag.! Syn., 122, 5; Proc. Bost. Soc. Nat. Hist., XV, 271, 30.

Hab. Massachusetts, July, August; New York; Maryland; Illinois; Detroit, Mich., June; White Mountains, New Hampshire, August.

11. Æschna juncea, ♂, ♀.

Æschna juncea Linne! Selys, Revue des Odonat.! 116, 3 (with the synonyms). — Hag.! Syn., 120, 3.

Æschna propinqua Scudd.! Proc. Bost. Soc. Nat. Hist., X, 215 (in part). — Hag., ibid, XV, 376.

Æschna Hudsonica Hag. Syn., 123, 7; Selys, Ent. Monthly Mag., No. 131, 242.

Hab. Kenai Island; Norton Sound, Alaska; Fort Resolution, Great Slave Lake, British America; White Mountains, New Hampshire, August; North Europe, North Asia.

The male type of Mr. Scudder belongs to *Æ. juncea*, the female to *Æ. clepsydra*; another male to *Æ. verticalis.*

12. Æschna interna, ♂, ♀.

Æschna interna Hag. (No description.)

Hab. Dakota; Yellowstone; Ogden, Utah.

13. Æschna mutata, ♀.

Æschna mutata Hag.! Syn., 124, 10.

Hab. N. America.

14. Æschna florida, ♀.

Æschna florida Hag.! Syn., 125, 12.

Hab. Mexico.

15. Æschna Dominicana.

Æschna Dominicana Hag., Syn., 126, 13. (No description.)

Hab. St. Domingo. Not known to me.

16. Æschna adnexa, ♂, ♀.

Æschna adnexa Hag.! Syn., 127, 17.

Hab. Cuba.

17. Æschna cyanifrons.

Æschna cyanifrons Hag., Syn., 126, 15. (No description.)

Hab. Jamaica. Perhaps *Æ. adnexa*, but not known to me.

18. Æschna grandis, ♂.

Æschna grandis Hag.! Syn., 126, 16.

Hab. Bergen Hill, New Jersey; Europe.

The single male I received twenty years ago from Mr. Guex, together with a considerable number of Odonata, all taken in the same place near New York, and all except *Æ. grandis* common North American species, induced me to believe that probably this male of *Æ. grandis* was introduced by a European ship. This is the more probable, as very near Bergen Hill are the immense wharves for the transatlantic steamers. At least, thus far no other specimen is known to be found in America. In a letter to Mr. Haldeman, still in my hands, Mr. Guex states, that he is perfectly sure he has not made a mistake in the locality.

19. Æschna virens, ♂, ♀.

Æschna virens Ramb., Neur., 193, 8.—Hag.! Syn., 127, 18.—Scudder! Proc. Bost. Soc. Nat. Hist., x, 190.—Hag., ibid, xi, 293; xv, 374; xvi, 351.—Uhler, Proc. Bost. Soc. Nat. Hist., xi, 295.

Hab. Cuba, Isle of Pines; Hayti; Panama; St. Cruz de Bolivia; Venezuela; Georgia, if my interpretation of Mr. Abbot's figure is correct.

20. Æschna ingens, ♂, ♀.

Æschna ingens Rbr., Neur., 192, 1.—Hag.! Syn., 128, 19.

Æschna Abboti Hag., Stett. Zeit., xxiv, 373, 55; Proc. Bost. Soc. Nat. Hist., xvi, 350, 3.

Hab. Georgia; St. Johns River, St. Augustin, Florida; Cuba.

New specimens from Florida have convinced me that *Æ. Abboti*, described from the figure by Abbot, is identical with *Æ. ingens*; the appendages of the figured specimen were probably broken.

21. Æschna Heros, ♂, ♀. (Subgenus Epiæschna Selys.)

Æschna Heros Fab., Ent. Syst., Suppl., 285.—Ramb.! Neur., 194, 4.—Hag.! Syn., 128, 20; Proc. Bost. Soc. Nat. Hist., xv, 271, 29; xvi, 351, 4.—Walsh! Proc. Acad. Philad., 1862, 397.

Æschna multicincta Say, Journ. Acad. Philad., viii, 9, 1.

Hab. Massachusetts, July, common at Nahant; Manchester; New York; New Jersey; Illinois; Maryland; Georgia; Virginia; Tennessee; Alabama; Louisiana; Florida; Mexico (Rambur).

22. Æschna brevifrons, ♂, ♀.

Æschna brevifrons Hag.! Syn., 129, 21.

Hab. Acapulco, Mexico; Valparaiso, Peru.

23. Æschna basalis, ♀.

Æschna basalis Selys, Mss., Hag. Syn., 130, 23. (No description.)

Hab. Canada. Not known to me.

24. Æschna pentacantha, ♂, ♀. (Subgenus Brachytron.)
Æschna pentacantha Ramb.! Neur., 208, 22. — Hag.! Syn., 129, 22. — Walsh! Proc. Acad. Philad., 1862, 397.
Hab. Illinois; New Orleans, Louisiana; Dallas, Texas.

Neuræschna.

1. Neuræschna vinosa, ♂, ♀.
Æschna vinosa Say! Journ. Acad. Philad., VIII, 13, 5.
Neuræschna vinosa Hag.! Proc. Bost. Soc. Nat. Hist., XV, 272, 34.
Æschna quadriguttata Burm.! Handb., II, 837, 22. — Selys! Revue Odonat. Europ., 398. — Hag.! Syn., 130, 24; Stett. Z., XXIV, 373; Proc. Bost. Soc. Nat. Hist., XVI, 351, 6.
Hab. Ontario, Canada; Maine; Massachusetts; Pennsylvania; Maryland; Washington, D. C.; Carolina; Georgia; Kentucky; Tennessee.

Gynacantha.

1. Gynacantha trifida, ♂, ♀.
Gynacantha trifida Ramb.! Neur., 210, 3.—Selys! Sagra Ins., Cuba, 459. — Hag.! Syn., 131, 1.
Hab. Cuba; Jamaica; Brazil.
Migrating in flocks, in December, in Cuba, from the north to the south.

2. Gynacantha septima, ♂, ♀.
Gynacantha septima Selys! Sagra Ins., Cuba, 460. — Hag.! Syn., 132, 2.
Hab. Jamaica; Cuba; Brazil.

3. Gynacantha gracilis, ♂, ♀.
Æschna gracilis Burm.! Handb., II, 837, 6. — Hag.! Syn., 315.
Gynacantha nervosa Rbr.! Neur., 213, 7.
Hab. Cuba, South America.

4. Gynacantha falco, ♂, ♀. (No description.)
Gynacantha falco Selys! Mss.
Gynacantha obscuripennis Hag.! Syn., 315.
Hab. Panama, South America.

5. Gynacantha mexicana, ♀.
Gynacantha Mexicana Selys, Ann. Soc. Ent. Belg., XI; Proc., 69, 6.
Hab. Mexico. Not known to me.

South America.

Subfamily ÆSCHNINA.

Anax.

1. Anax Amazili, ♂, ♀. (cf. N. America.)
Anax Amazili Hag.! Syn., 314.
Hab. Venezuela; Brazil, Amazon, Para, Pernambuco, Rio.

2. Anax concolor, ♂.
Anax concolor Brauer, Novara Voyage, 66, pl. I, f. 15.
Hab. Brazil, Rio Negro. Not known to me.

Æschna.

1. Æschna virens, ♂, ♀. (cf. North America.)
Æschna virens Hag., Syn., 314.
Hab. St. Cruz de Bolivia; Venezuela; Brazil, Amazon.

2. Æschna variegata.
Æschna variegata Fabr., Syst. Ent., 425, 3; Spec. Ins., I, 526, 3; Mant. Ins., I, 339, 3; Ent. Syst., II, 384, 2. — Hag., Syn., 314.
Hab. Terra del Fuego. Not known to me.

3. Æschna rufina, ♂.
Æschna rufina Hag.! Overs. Dansk. Vid. Selsk. Foerhdl., 1855, 125. —Hag.! Syn., 314. (No description.)
Æschna erythroneura Selys! Mss.
Hab. Brazil, Minas Geraes.

4. Æschna depravata, ♂.
Æschna depravata Hag.! Syn., 314. (No description.)
Hab. Brazil, New Fribourg. (Group of *Æ. armata.*)

5. Æschna lobata, ♂.
Æschna lobata Hag.! Syn., 314. (No description.)
Hab. Brazil, New Fribourg. (Group of *Æ. armata.*)

6. Æschna Marchali ♂.
Æschna Marchali Ramb., Neur., 203, 14; Hag.! Syn., 314.
Hab. Columbia, St. Fe de Bogota.

7. Æschna diffinis, ♂, ♀.
Æschna diffinis Ramb.! Neur., 203, 15; Gay, Chili, VI, 116, pl. 2, f. 6. — Hag. Syn., 314.

Æschna configurata Hag.! Syn., 314; Oevers. Dansk. Selsk. Vid. Foerhdl., 1855, 121.

Hab. Chili, Quillota; Valparaiso; Peru, Lima.

8. Æschna bonariensis, ♂, ♀.

Æschna bonariensis Rbr.! Neur., 204, 16. — Hag.! Syn., 314.

Hab. Buenos Ayres; Brazil, Montevideo; St. Mathias Bay, Patagonia.

9. Æschna confusa, ♂, ♀.

Æschna confusa Rbr., Neur., 205, 17. — Hag.! Syn., 314.

Hab. Buenos Ayres; Cordova; Brazil, Montevideo, Febr.; Curico, Chili, May.

Perhaps a new species, if Rambur's *Æ. confusa* belongs to *Æ. bonariensis.*

10. Æschna laticeps, ♂, nov. sp. (Hag.; no description.)

Hab. Cordova, Argentine Republic.

11. Æschna cornigera, ♂, ♀.

Æschna cornigera Brauer, Novara Voyage, 70, pl. I, fig. 16.—Hag.! Verhdl. Wien Z. B., XVII, 49.

Æschna jucunda Hag.! Syn., 314.

Æschna chlorophana Burm.! Mss.

Hab. Columbia; Porto Cabello, Venezuela; Brazil, New Fribourg, Montevideo, S. Leopoldo.

12. Æschna macromia, ♂.

Æschna macromia Brauer, Voyage Novara, 68, pl. I, fig. 18.—Hag.! Verhdl. Wien, Z. B., XVII, 49.

Æschna prasina Hag.! Syn., 314.

Hab. Brazil, Pernambuco.

13. Æschna luteipennis, ♂, ♀.

Æschna luteipennis Burm.! Handb., II, 837, 4. — Hag.! Syn., 314.

Æschna excisa Brauer, Voyage Novara, 69, pl. I, f. 19. — Hag., Verhdl. Wien, Z. B. G., XVII, 50.

Hab. Brazil, S. Leopoldo.

14. Æschna brevifrons, ♂, ♀. (cf. N. America.)

Hab. Chili, Valparaiso.

15. Æschna obscuripennis.

Æschna obscuripennis Voyage d'Orbigny, Neur., pl. 28, f. 3.

Hab. Bolivia. Not known to me; perhaps *Æ. brevifrons?*

16. Æschna castor, ♂, ♀.

Æschna castor Brauer, Voyage Novara, 72, pl. I, f. 17. — Hag.! Verhdl. Wien, Z. B. G., XVII, 50.

Æschna lunulata Selys, Mss.

Hab. Brazil, Rio.

17. Æschna Januaria, ♂, ♀.

Æschna Januaria Hag.! Overs. Dansk. Vid. Selsk. Forhdl., 1855, 125; Syn., 315; Verhdl. Wien, Z. B. G., XVII, 51.

Hab. Brazil, Rio.

18. Æschna cyanifrons. (cf. N. America.)

Hab. Brazil, Amazon. Not known to me.

19. Æschna accipiter.

Æschna accipiter Selys, Mss. (No description.)

Hab. Brazil, Amazon. Not known to me.

Staurophlebia.

1. Staurophlebia reticulata, ♂, ♀.

Æschna reticulata Burm.! Handb., II, 837, 5. — Hag.! Syn., 314.

Æschna gigas Rbr.! 193, 2.

Staurophlebia magnifica Brauer, Voyage Novara, 74, pl. II, f. 1. — Hag.! Verhdl. Wien, Z. B. G., XVII, 53.

Hab. Venezuela, Porto Cabello; Surinam; Guiana; Brazil, Amazon, Para.

2. Staurophlebia gigantula.

Megalæschna gigantula Selys, Mss. (No description.)

Hab. Amazon. Not known to me.

Neuræschna.

1. Neuræschna costalis, ♂, ♀.

Æschna costalis Burm.! Handb., II, 837, 3. — Hag.! Syn., 314; Verhdl. Wien, Z. B. G., XVII, 55.

Gynacantha ferox Erichs.! Schomburgk Voyage Guiana, III, 585.

Hab. Guiana; Brazil, Bahia, Amazon.

2. Neuræschna grossa Selys, Mss. (No description.)

Hab. Brazil, Amazon. Not known to me.

3. Neuræschna subcostalis Selys, Mss. (No description.)

Hab. Brazil, Amazon. Not known to me.

4. Neuræschna Comus Selys, Mss. (No description.)

Hab. Brazil, Amazon. Not known to me.

5. Neuræschna Harpyia Selys, Mss. (No description.)

Hab. Brazil, Amazon. Not known to me.

Gynacantha.

1. **Gynacantha falco,** ♂, ♀. (cf. N. America.)
Gynacantha falco Selys ! Mss. (No description.)
Gynacantha obscuripennis Hag. ! Syn., 315.
Hab. Columbia, St. Fé de Bogota ; Venezuela ; Surinam ; Brazil, Amazon, Panama.

2. **Gynacantha bifida,** ♂, ♀.
Gynacantha bifida Rbr.! Neur., 213, 6.
Hab. Brazil.

3. **Gynacantha auricularis** Selys, Mss. (No description.)
Hab. Brazil, Amazon. Not known to me.

4. **Gynacantha longipennis** Selys, Mss. (No description.)
Hab. Brazil, Amazon. Not known to me.

5. **Gynacantha bellicosa** Selys, Mss. (No description.)
Hab. Brazil, Amazon. Not known to me.

6. **Gynacantha lanceolata,** ♂.
Gynacantha lanceolata Hag. ! Syn., 315. (No description.)
Hab. Pernambuco.

7. **Gynacantha gracilis,** ♂, ♀. (cf. N. America.)
Æschna gracilis Burm.! Handb., II, 837, 6. — Hag.! Syn., 315.
Gynacantha nervosa Rbr. ! Neur., 213, 7.
Æschna robusta Erichs.! Mus. Berol.
Hab. Cuba ; Surinam ; St. Cruz de Bolivia ; Guiana ; Brazil, Pernambuco, Rio, Para.

8. **Gynacantha trifida,** ♂, ♀.
Gynacantha trifida Rbr.! Hag., Syn., 315. (cf. N. America.)
Hab. Brazil, Amazon ; Cuba.

9. **Gynacantha septima,** ♂ ♀.
Gynacantha septima Selys ! (cf. N. America), Hag.! Syn., 315.
Hab. Brazil, Amazon ; Cuba ; Jamaica.

10. **Gynacantha conica,** ♂, ♀.
Gynacantha conica Hag. ! Syn., 315. (No description.)
Hab. Venezuela ; Surinam. Perhaps identical with *G. septima*.

11. **Gynacantha prædatrix** Selys, Mss. (No description.)
Hab. Brazil, Amazon. Not known to me.

12. **Gynacantha angusta,** ♂.
Æschna angusta Hag.! Syn., 314. (No description.)
Hab. Brazil.

13. Gynacantha elata, ♂.

Gynacantha elata Hag. ! Syn., 315. (No description.)

Hab. Brazil, New Fribourg.

14. Gynacantha tenuis, ♂.

Gynacantha tenuis Hag.! Syn., 315. (No description.)

Hab. Brazil.

Subfamily GOMPHINA.

Herpetogomphus.

1. Herpetogomphus designatus, ♂, ♀.

Erpetogomphus designatus Selys ! Monogr., 401, 16 ter., pl. 20, f. 1; Syn. Addit., I, 10, 21 bis. — Hag. Syn. ! 99, 2.

Hab. Pecos River, Western Texas, July 6–16; Waco, Texas, July 14–25.

Nympha raised at Poles' Creek, Texas, Cabot, 4, 6, pl. 2, f. 6. (*Gomphus* spec., No. 6.)

2. Herpetogomphus compositus, ♂, ♀.

Erpetogomphus compositus Selys ! Monogr., 400, 16 bis, pl. 20, f. 2; Syn. Addit., I, 10, 21 ter; Addit., III, 12, 21 ter.— Hag. Syn.! 99, 1; Hayden's Rep., 1873, 597.

Herpetogomphus viperinus Hag. ; Hayden's Rep., 1872, 727.

Hab. Pecos River, Western Texas, Aug. 15; Dallas, N. Texas; Yellowstone ; Oregon.

3. Herpetogomphus viperinus, ♂, ♀.

Erpetogomphus viperinus Selys, Ann. Soc. Ent. Belg., XI ; Proc., 68; Syn. Addit., II, 13, 21 sept.

Hab. Orizaba, Mexico.

4. Herpetogomphus elaps, ♂, ♀.

Erpetogomphus elaps Selys! Monogr., 70, 16, pl. 4, f. 4; Syn. Addit., I, 12, 21 sext. ; Addit., II, 12, 21 sext. — Hag. Syn.! 100, 5.

Hab. Orizaba, Atlihuazan, Cuernavaca, Mexico.

5. Herpetogomphus boa, ♂, ♀.

Erpetogomphus boa Selys ! Syn. Addit., I, 11, 21 quart.— Hag. Syn.! 100, 3.

Hab. Vera Cruz, Mexico.

6. Herpetogomphus cophias, ♂, ♀.

Erpetogomphus cophias Selys! Monogr., 72, 17, pl. 4, f. 6; Syn. Addit., I, 11, 21 quint. ; Addit., II, 13, 21 quint. — Hag. Syn ! 100, 4.

Hab. Trojes del Oro, Mexico.

7. Herpetogomphus crotalinus, ♂, ♀.

Erpetogomphus crotalinus Selys! Monogr., 72, 18, pl. 4, f. 5; Syn., 21, 21; Addit., II, 11, 21. — Hag. Syn.! 101, 6.

Erpetogomphus Menetriesi Selys! Syn., 20, 20.

Hab. Mexico; Brazil.

Ophiogomphus.

1. Ophiogomphus rupinsulensis, ♂, ♀.

Herpetogomphus rupinsulensis Walsh! Proc. Acad. Philad., 1862, 388; Proc. Ent. Soc. Philad., I, 254.

Erpetogomphus rupinsulensis Selys, Syn. Addit., II, 44, 21 octo.

Ophiogomphus rupinsulensis Selys, Syn. Addit., III, 13, 21 octo. (partim; only the male). — Hag., Hayden's Rep., 1873, 594.

Hab. Rock Island, Illinois; Upper Wisconsin; Maine; Ontario, Canada.

In the female the left spine behind the occiput was of different form in four specimens.

2. Ophiogomphus mainensis, ♂, ♀.

Ophiogomphus mainensis Walsh! Proc. Ent. Soc. Philad., I, 255 nota. — Selys, Syn. Addit., II, 45, 22 bis.

Ophiogomphus rupinsulensis Selys! Syn. Addit., III, 13, 22 bis. (partim; only the female).

Ophiogomphus mainensis Hag.! Hayden's Rep., 1873, 595.

Hab. Maine. Only one male and the typical female are known, both from the same locality and the same collector, Dr. A. S. Packard.

3. Ophiogomphus Bison, ♂.

Ophiogomphus Bison Selys, Syn. Addit., III; Append., 51, 22 ter.

Hab. California. Not known to me.

4. Ophiogomphus colubrinus, ♂, ♀.

Ophiogomphus colubrinus Selys! Monogr., 76, 19, pl. 5, f. 1; Syn., 21, 22. — Hag. Syn! 101, 7. — Hayden's Rep., 1873, 592.

Hab. Hudson's Bay Territory; Portneuf, near Quebec, Canada; N. Hampshire.

5. Ophiogomphus severus, ♂, ♀.

Ophiogomphus severus Hag.! Hayden's Rep., 1873, 591.

Hab. Colorado, foothills and plains, end of September; Fort Garland, Col., June 27; South Montana and Yellowstone, N. Mexico.

Given doubtfully in Hayden's Rep., 1872, 727, as *O. colubrinus* by me.

Octogomphus.

1. Octogomphus specularis, ♂, ♀.

Neogomphus? specularis Selys! Syn. Add., I, 18, 64 bis. — Hag. Syn.! 110, 27.

Octogomphus specularis Selys! Syn. Addit., III, 32, 64 bis.

Hab. Ft. Tejon, Cal.; San Mateo and Crystal Springs, Cal.

Dromogomphus.

1. Dromogomphus spinosus, ♂, ♀.

Dromogomphus spinosus Selys! Monogr., 120, 35, pl. 7, f. 2; Syn., 40, 51. — Hag. Syn.! 102, 8; Stett. Z., XXIV, 373, 43; Proc. Bost. Soc. Nat. Hist., XVI, 359, 16.

Gomphus spinosus Hag.! Foerhdl. Dansk. V. S., 1855, 125. — Walsh! Proc. Acad. Philad., 1862, 391.

Hab. Georgia, June 6; Bee Spring, Kentucky, June; Des Plaines River, near Chicago, Ill.; Dallas, Texas.

2. Dromogomphus spoliatus, ♂.

Gomphus spoliatus Selys! Monogr., 409, 36 bis, pl. 21, f. 1; Syn. Addit., I, 17, 32 bis. — Hag. Syn.! 103, 10.

Hab. Pecos River, Western Texas. One male known.

3. Dromogomphus armatus, ♂.

Gomphus armatus Selys! Monogr., 122, 36; Syn., 40, 50; Addit., III, 54, 52. — Hag. Syn.! 102, 9.

Hab. N. America. One male in the British Museum known. After a repeated and detailed examination of the typical male, Baron De Selys Longchamps is sure of the difference from *D. spoliatus*. I noted down in 1861, after my examination of the same male, that *D. spoliatus* is only the teneral stage of *D. armatus*.[1]

Gomphus.

1. Gomphus pallidus, ♀.

Gomphus pallidus Ramb.! Neur., 163, 12. — Selys! Monogr., 145,

[1] The diagram of the appendages and genital parts of *D. armatus*, made by myself in London, if correct, are different from those of *D. spoliatus*, and would justify the statement of Baron De Selys Longchamps. The superior appendages of *D. armatus* are, viewed from the side, longer and sharply pointed; the inferior shorter, reaching about the angles of the superiors. The hamulus is longer than in *D. spoliatus*.

47, pl. 8, f. 6 (partim.); Syn., 33, 40. — Hag. Syn.! 105, 16; Stett. Z, XXIV, 373, 45; Proc. Bost. Soc. Nat. Hist., XVI, 358, 14.

Hab. Georgia, May 15. Probably belonging to *G. pilipes.*

2. Gomphus pilipes, ♂, ♀.

Gomphus pilipes Selys! Monogr., 148, 48, pl. 8, f. 7; Syn. Addit., I, 15, 40 bis. — Hag. Syn.! 106, 17; Stett. Z., XXIV, 373, 46; Proc. Bost. Soc. Nat. Hist., XVI, 359, 15.

Hab. Georgia; New Orleans.

3. Gomphus villosipes, ♂, ♀.

Gomphus villosipes Selys! Syn., 34, 41. — Hag. Syn.! 105, 15.

Gomphus pallidus Selys! Monogr., 145, 47 (partim; only the male).

Hab. Natick, Mass., June 4; Detroit, Mich., June.

4. Gomphus lividus, ♂, ♀.

Gomphus lividus Selys! Monog., 150, 49, pl. 11, f. 1.; Syn., 34, 42. — Hag. Syn.! 106, 18.

Gomphus sordidus Selys! Syn., 35, 43 (male).

Hab. S. Carolina; Washington, D. C.; Natick, Mass.

5. Gomphus militaris, ♂, ♀.

Gomphus militaris Selys! Monogr., 416, 51 bis., pl. 21, f. 3; Syn. Addit., I, 16, 44 bis. — Hag. Syn.! 107, 20.

Hab. Pecos River, Western Texas, July 5–Aug. 14; a female, Waco, Texas, May 22, differs slightly.

6. Gomphus intricatus, ♂.

Gomphus intricatus Selys! Monogr., 418, 51 ter., pl. 21, f. 3; Syn. Addit., I, 16, 44 ter. — Hag. Syn.! 108, 21.

Hab. Pecos River, Western Texas, June 2; Missouri, July 1.

7. Gomphus minutus, ♂, ♀.

Gomphus minutus Ramb.! Neur., 161, 9. — Selys! Monogr., 155, 51, pl. 11, f. 3; Syn., 36, 45. — Hagen! Syn., 108, 32; Stett. Z., XXIV, 373, 47; Proc. Bost. Soc. Nat. Hist., XVI, 359, 18.

Hab. Georgia, March 29.

8. Gomphus exilis, ♂, ♀.

Gomphus exilis Selys! Monogr., 156, 52; Syn., 36, 46; Addit., III, 21, 46.—Hag. Syn.! 108, 23; Proc. Bost. Soc. Nat. Hist., XV, 273, 36.

Hab. Maryland; Sutton, Massachusetts, June; Natick, May 31–June 30.

9. Gomphus notatus, ♂, ♀.

Gomphus notatus Ramb.! Neur., 162, 10. — Selys! Monogr., 159, 55; Syn., 39, 49 (male). — Hag.! Syn., 110, 26.

Gomphus elongatus Selys! Syn., 39, 50 (female).

Hab. N. America. The male in the Paris Museum, the female in the British Museum.

In the Syn. Addit., III, p. 77, Baron De Selys separates the two species again, perhaps inadvertently, as there is no further account given.

10. Gomphus amnicola, ♂, ♀.

Gomphus amnicola Walsh! Proc. Acad. Philad., 1862, 396.—Selys, Syn. Add., II, 21, 48 bis.

Hab. Rock Island, Ill.

11. Gomphus spiniceps, ♀.

Macrogomphus spiniceps Walsh, Proc. Acad. Philad., 1862, 389; Proc. Ent. Soc. Philad., I, 256 nota.—Selys, Syn. Addit., II, 42, 3 bis.

Gomphus spiniceps Selys, Syn. Addit., III, 23, 48 quint.

Nympha raised. Cabot! 5, 8, pl. 2, f. 1, male (rudimentary).

Hab. Rock Island, Ill.; Lawrence, Mass., July 4–24.

12. Gomphus fluvialis, ♂, ♀.

Gomphus fluvialis Walsh! Proc. Acad. Philad., 1862, 394; Proc. Ent. Soc. Philad., I, 252. — Selys! Syn. Addit., II, 22, 48 ter.

Rock Island, Ill., and Southern Illinois; Detroit, Michigan.

Nympha (raised) from Detroit.

13. Gomphus plagiatus, ♂, ♀.

Gomphus plagiatus Selys! Monogr., 159, 54; Syn., 38, 48. — Hag.! Syn., 109, 25.

Hab. Maryland; Port Royal, S. Carolina.

14. Gomphus olivaceus, ♀.

Gomphus olivaceus Selys, Syn. Addit., III, 21, 48 quart. — Hag.! Hayden's Rep., 1873, 597.

Hab. Humboldt River, Nebraska; California; (perhaps Oregon).

15. Gomphus parvulus, ♂, ♀.

Gomphus parvulus Selys! Monogr., 157, 53, pl. 22, f. 1; Syn., 37, 47. — Hag.! Syn., 109, 24.

Hab. Nova Scotia; White Mountains, N. Hampshire, June 17; Maine; Berks Co. and York Co., Pennsylvania.

16. Gomphus Scudderi, ♀.

Gomphus Scudderi Selys, Syn. Addit., III, 24, 52 ter.

Hab. N. America. Unknown to me; only one female.

17. Gomphus dilatatus, ♂, ♀.

Gomphus dilatatus Ramb.! Neur., 155, 2. — Selys! Monogr., 123, 37, pl. 7, f. 3; Syn., 28, 31. — Hag.! Syn., 103, 11; Stett. Z., XXIV, 373, 44; Proc. Bost. Soc. Nat. Hist., XVI, 359, 17.

Hab. Georgia, May 24; Florida; Lansing, Mich.

18. Gomphus vastus, ♂, ♀.

Gomphus vastus Walsh! Proc. Acad. Philad., 1862, 391. — Selys! Syn. Addit., II, 13, 31 ter.

Hab. Rock Island, Ill.; Maryland (?); N. York; Tyngsboro, Mass. (?); Washington, D. C.

19. Gomphus ventricosus, ♂, ♀.

Gomphus ventricosus Walsh, Proc. Ent. Soc. Philad., I, 249.— Selys, Syn. Addit., II, 14, 31 quart.

Hab. Rock Island, Ill., one male; Dalton, Virginia.

The female from Virginia in my collection, formerly my *G. ignavus*, belongs very probably to *G. ventricosus*.

20. Gomphus externus, ♂, ♀.

Gomphus externus Selys! Monogr., 411, 37 bis; pl. 21, f. 2; Syn. Addit., I, 14, 31 bis. — Hag.! Syn., 104, 12.

Hab. Pecos River, Western Texas, July 5; Nebraska.

21. Gomphus consobrinus, ♂, ♀.

Gomphus consobrinus Walsh! Proc. Ent. Soc. Philad., I, 242; Selys! Syn. Addit., II, 15, 32 bis.

Hab. Rock Island, Ill.; Bee Spring, Kentucky.

22. Gomphus quadricolor, ♂.

Gomphus quadricolor Walsh, Proc. Ent. Soc. Philad., I, 246. — Selys, Syn. Addit., II, 19, 38 ter.

Hab. Rock Island, Ill., one male; two males from Mt. Tom, Mass., and Lansing, Mich., probably belong to this species.

23. Gomphus graslinellus, ♂, ♀.

Gomphus graslinellus Walsh! Proc. Acad. Phil., 1862, 394; Proc. Ent. Soc. Philad., I, 242. — Selys! Syn. Addit., I, 16, 32 ter.

Hab. Rock Island, Ill.

24. Gomphus spicatus, ♂, ♀.

Gomphus spicatus Selys! Monogr., 153, 50; 415, 50, pl. 9, f. 2; Syn., 34, 44; Addit., II, 20, 44. — Hag. Syn.! 107, 19.

Hab. Ontario, Canada; Natick, Mass, June 4; New York.

25. Gomphus fraternus, ♂, ♀.

Æschna fraternus Say, Journ. Acad. Philad., VIII, 16, 9.

Gomphus fraternus Selys! Monogr., 125, 38, pl. 7, f. 4; Syn., 28, 32. — Hag. Syn., 104, 14. — Walsh, Proc. Acad. Philad., 1862, 393; Proc. Ent. Soc. Philad., I, 238.

Hab. New York, Rock Isl., Ill.; Dallas, Texas (probably); New Hampshire (probably).

26. Gomphus confraternus, ♂, ♀.

Gomphus confraternus Selys, Syn. Addit., III, 16, 32 bis.

Hab. California. Unknown to me.

27. Gomphus adelphus, ♂.

Gomphus adelphus Selys! Monogr., 413, 38 bis; Syn. Addit., I, 15, 34 ter.

Hab. New York.

28. Gomphus sobrinus, ♂.

Gomphus sobrinus Selys, Syn. Addit., III, 18, 32 ter.

Hab. California. Unknown to me.

PROGOMPHUS.

1. Progomphus obscurus, ♀.

Diastatomma obscurum Rbr.! Neur., 170, 5.

Progomphus obscurus Selys! Monogr., 201, 70; Syn., 53, 69.—Hag. Syn., 110, 1.

Hab. N. America.

A female from Boston, Mass., July; may belong to *P. obscurus.* Perhaps the nympha from Wareham, Mass., belongs to this species. Cabot, 6, 9, pl. 2, f. 3.

2. Progomphus borealis, ♂, ♀.

Progomphus borealis Selys, Syn. Addit., III, 36, 68 bis. — Hag.! Proc. Bost. Soc. Nat. Hist., XVI, 356, 13.

Hab. Oregon; Georgia; Dallas, Texas.

I have seen two males from Georgia and Texas, and the figure of male and female by Abbot. Mr. McLachlan states that the two small teeth before the tip of the inferior appendage (cf. Proc. Bost. Soc. Nat. Hist., XVI. 358) are present; there is no further doubt about the identity of the males from Oregon and Georgia.

3. Progomphus zonatus, ♀.

Progomphus zonatus Selys! Monogr., 203, 71, pl. 11, f. 3; Syn., 53, 70. — Hag.! Syn., 111, 2.

Hab. Mexico.

4. Progomphus integer, ♂, ♀.

Progomphus integer Hag. coll. — Selys, Syn. Addit., II, 45. (No description.)

Hab. Cuba.

5. Progomphus serenus, ♂.

Progomphus serenus Hag. coll. (No description.)

Gomphoides spec. Uhler! Proc. Bost. Soc. Nat. Hist., XI, 295.

Hab. Hayti; Jérémie.

Gomphoides.

1. Gomphoides suasa, ♂, ♀.

Gomphoides suasa Selys! Syn. Addit., I, 19, 72 bis.; Addit., II, 28, 72 bis; Addit., III, 59, 72 bis. — Hag. Syn.! 112, 2.

Gomphoides perfida Hag.! Syn. 112, 3, male.

Race, *Gomphoides pacifica* Selys, Syn. Addit., III, App. 60, 72 ter. and 81.

Hab. Vera Cruz, Tampico, Putla, Mexico.

2. Gomphoides ambigua, ♀.

Gomphoides ambigua Selys, Syn. Addit., III, App. 61, 75 quart.

Hab. Guatemala.

3. Gomphoides stigmata, ♂, ♀.

Æschna stigmata ? Say, Journ. Acad. Philad., VIII, 17, 10.

Progomphus stigmatus Selys! Monogr., 205, 72; Syn., 53, 71.

Gomphoides stigmata Selys! Monogr., 423, 72, pl. 21, f. 5; Syn. Addit., II, 28, 71.

Hab. Pecos River, Texas.

Aphylla.

1. Aphylla producta, ♂, ♀.

Aphylla producta Selys! Monogr., 230, 83, pl. 12, f. 6; Syn.,60, 81.

Aphylla Caraiba Selys! Sagra, Ins. Cuba, 456.

Gomphoides producta Hag.! Syn., 113, 6.

Hab. Cuba; British Guiana; Bahia, Brazil.

Cyclophylla.

1. Cyclophylla elongata, ♂.

Cyclophylla elongata Selys! Monogr., 224, 84, pl. 12, f. 5; Syn. Addit., I, 20, 79 ter.

Gomphoides elongata Hag.! Syn., 113, 4.

Hab. Mexico. One male.

2. Cyclophylla protracta, ♂, ♀.

Cyclophylla protracta Selys! Syn. Addit., 20, 79 ter.

Gomphoides protracta Hag.! Syn., 113, 5.

Hab. Matamoras, Mexico.

Hagenius.

1. Hagenius brevistylus, ♂, ♀.

Hagenius brevistylus Selys! Monogr., 241, 86, pl. 13, f. 2; Syn., 63, 84.—Hag. Syn.! 114, 1; Proc. Bost. Soc. Nat. Hist., XV, 272, 35.

Nympha raised. Cabot, Cat. Mus. Comp. Zool., v, 9, 12, pl. 3, f. 4.

Hab. New York; Sutton, Mass.; Upper Wisconsin River; Ottawa, Canada; Osage, Kansas; San Antonio, Texas; Maryland; Columbia, S. America.

Tachopteryx.

1. Tachopteryx Thoreyi, ♂, ♀.

Uropetala Thoreyi Selys! Monogr., 373, 122, pl. 19, f. 3; Syn. Addit., I, 25, 116 bis.

Petalura Thoreyi Hag.! Syn., 117, 1.

Hab. Massachusetts (Uhler Coll.); New York; Maryland; Fort Towson, S. Red River; Bee Spring, Kentucky, May.

The nympha (supposed) from Kentucky.

Subfamily CORDULEGASTERINA.

Cordulegaster.

1. Cordulegaster Sayi, ♂, ♀.

Cordulegaster Sayi Selys! Monogr., 331, 19; Syn., 85, 106; Addit., II, 40, 106. — Hag. Syn.! 115, 1; Stett. Z., XXIV, 378, 48; XXVIII, 99; Proc. Bost. Soc. Nat. Hist., XV, 273, 37; 376, 1; XVI, 356, 10.

Cordulegaster lateralis Scudder! Proc. Bost. Soc. Nat. Hist., x, 211; XI, 300.

Hab. Port Neuf, Canada; White Mountains, N. Hampshire, July 15; Portland, Me.; Stow, Cambridge, July, Massachusetts; Maryland; Ogechee River, Georgia, March 30.

Nympha (supposed), Cabot, l. c., 13, 15, pl. 3, f. 2.

2. Cordulegaster maculatus, ♂, ♀.

Æschna obliqua Say, var. A.! Journ. Acad. Philad., VIII, 16, 8.

Cordulegaster maculatus Selys! Monogr., 337, 111; Syn., 86, 108.— Hag. Syn.! 115, 2; Stett. Z., XXIV, 373, 49; Proc. Bost. Soc. Nat. Hist., XV, 273, 38; XVI, 352, 11.

Hab. Woburn, Mass.; Connecticut; Maryland; Georgia, March 20; Ontario, Canada.

3. Cordulegaster dorsalis, ♂, ♀.

Cordulegaster dorsalis Selys! Monogr., 347, 115; Syn. Addit., I, 28, 113 bis; Addit., III, 44, 113 bis. — Hag. Syn.! 116, 3.

Hab. Sitka, Alaska; Oregon.

4. Cordulegaster obliquus, ♂, ♀.

Æschna obliqua Say, Journ. Acad. Philad., VIII, 15, 8.

Cordulegaster fasciatus Ramb.! Neur., 178, 1.

Cordulegaster obliquus Selys! Monogr., 349, 116, pl. 18, f. 5; Syn., 89, 113. — Hag. Syn.! 116, 4; Stett. Z., XXIV, 373, 50; Proc. Bost. Soc. Nat. Hist., XVI, 356, 12. — Walsh, Proc. Acad. Philad., 1862, 397.

Hab. Brookline, Mass.; Orono, Maine; Connecticut; Georgia; Indiana; Illinois; Kentucky, June.

5. Cordulegaster Diadema, ♂, ♀.

Cordulegaster Diadema Selys, Ann. Soc. Belg., XI; Proc., 68; Syn. Addit., II, 40, 108 bis.

Hab. Orizaba, Cuernavaca, Mexico. Unknown to me.

Gomphina from South America.

HERPETOGOMPHUS.

1. Herpetogomphus Menetriesii, ♀.

Ophiogomphus Menetriesii Selys, Syn., 20, 20. — Syn. Addit., III, App., 75.

Ophiogomphus crotalinus Selys! Monogr., 75 nota.—Hag. Syn., 312.

Hab. Brazil.

The short description of the male was taken from a diagnosis made long before the publication of the Monograph; the only female at hand slightly differed from *H. crotalinus*. Other specimens are needed to confirm the identity or nonidentity with *H. crotalinus*.

NEOGOMPHUS.

1. Neogomphus molestus, ♂, ♀.

Progomphus molestus Hag.! Foerhdl. Dansk. V. S., 1855, 121.

Neogomphus molestus Selys! Monogr., 183, 65, pl. 10, f. 4; Syn., 48, 64. — Hag. Syn.! 312.

Hab. Salto Grande and Quillota, Chili.

Hemigomphus elegans Selys, Syn., 48, 63, was based on a male from the interior of Brazil, no longer accessible when the Monograph was published, and then united with *N. molestus*. In the list, Syn. Addit., III, Append. 80, it is given again as a different species, but no description added.

CYANOGOMPHUS.

1. Cyanogomphus Waltheri, ♂.

Cyanogomphus Waltheri Selys, Syn. Addit., III, 27, 53 ter.

Hab. Rio Janerio, Brazil, November.

One male; unknown to me.

Epigomphus.

1. Epigomphus paludosus, ♂, ♀.

Epigomphus paludosus Selys! Monogr., 85, 22, pl. 5, f. 4; Syn., 41, 53; Addit., III, 28, 53.—Hag. Syn., 312.

Hab. Minas Geraes, Brazil.

2. Epigomphus obtusus, ♂, ♀.

Epigomphus obtusus Selys, Syn. Addit., II, 24, 53 bis; Addit., III, 29, 53 bis.

Hab. St. Paulo, Upper Amazon; Peba, Brazil; Bogota, New Granada. Unknown to me.

Agriogomphus.

1. Agriogomphus sylvicola, ♀.

Agrigomphus sylvicola Selys, Syn. Addit., III, 27, 53 bis.

Hab. St. Paulo and Ega, Upper Amazon. Unknown to me.

Progcmphus.

1. Progomphus paucinervis, ♀.

Progomphus paucinervis Selys, Syn. Addit., III, 54, 66 bis.

Hab. Quito, Ecuador. One female; unknown to me.

2. Progomphus pygmæus, ♂.

Progomphus pygmæus Selys, Syn. Addit., III, Append., 58, 66 ter.

Hab. Bogota, New Granada. Unknown to me.

3. Progomphus gracilis, ♂, ♀.

Progomphus gracilis Selys! Monogr., 196, 67, pl. 10, f. 6; Syn., 51, 66.—Hag. Syn.! 312.

Hab. New Fribourg, Brazil.

4. Progomphus complicatus, ♂, ♀.

Progomphus complicatus Selys! Monogr., 198, 68, pl. 11, f. 1; Syn., 51, 67; Addit., II, 27, 67; Addit., III, 35, 67.—Hag. Syn.! 312.

Hab. Tijuca and Carrancas, Minas, Brazil, November.

5. Progomphus intricatus, ♂, ♀.

Progomphus intricatus Selys! Monogr., 421, 68 bis., pl. 22, f. 3; Syn. Addit., I, 19, 67 bis.—Hag. Syn.! 313.

Hab. Para, Amazon, Brazil.

6. Progomphus costalis, ♂.

Progomphus costalis Selys! Monogr., 200, 96, pl. II, f. 2; Syn., 52, 68.—Hag. Syn., 312.

Hab. Brazil.

Gomphoides.

1. Gomphoides infumata, ♂.

Diastatomma infumatum Rbr.! Neur., 170, 4.

Gomphoides infumata Selys! Monogr., 210, 73, pl. 11, f. 4; Syn., 55, 72. — Hag.! Syn., 313.

Hab. Brazil. One male.

2. Gomphoides fuliginosa, ♀.

Gomphoides fuliginosa Selys! Monogr., 211, 74, pl. 11, f. 5; Syn., 55, 73. — Hag.! Syn., 313; Foerhdl., Dansk. V. S., 1855, 125.

Hab. Essequibo, Guiana. One female.

3. Gomphoides audax, ♀.

Gomphoides audax Selys! Monogr., 213, 75, pl. 11, f. 6; Syn., 56, 74. — Hag.! Syn., 313.

Hab. Brazil. One female.

4. Gomphoides semicircularis, ♂.

Gomphoides semicircularis Selys! Monogr., 215, 76, pl. 12, f. 1; Syn., 57, 75.

Hab. South America probably. The single male had the label Guinea, perhaps erroneously.

5. Gomphoides regularis, ♂, ♀.

Gomphoides regularis Selys, Syn. Addit., III, 37, 85 ter.

Hab. Carrancas, Brazil, November. Unknown to me.

6. Gomphoides annectens, ♂.

Gomphoides ? annectens Selys, Syn. Addit., II, 29, 75 bis.

Hab. New Fribourg, Brazil. Unknown to me.

Aphylla.

1. Aphylla edentata, ♂, ♀.

Aphylla edentata Selys, Syn. Addit., II, 33, 80 ter.

Hab. Ega, Upper Amazon. Unknown to me.

2. Aphylla brevipes, ♂, ♀.

Aphylla brevipes Selys! Monogr., 227, 82; Syn., 59, 80.

Hab. Para, Brazil.

3. Aphylla tenuis, ♂.

Aphylla tenuis Selys! Monogr., Syn. Addit., I, 21, 80 bis. — Hag.! Syn., 117, 4.

Hab. New Granada.

4. Aphylla dentata, ♂, ♀.

Aphylla dentata Selys! Syn. Add., I, 21, 81 bis.

Hab. Amazon.

5. Aphylla Molossus, ♂.

Aphylla Molossus Selys, Syn. Addit., II, 33, 81 ter.

Hab. Santarem, Amazon; perhaps a race of *A. dentata*; unknown to me.

6. Aphylla producta. (cf. N. America.)

Hab. British Guiana; Bahia, Brazil.

ZONOPHORA.

1. Zonophora angustipennis, ♂, ♀.

Diaphlebia angustipennis Selys! Monogr., 237, 85; Syn., 62, 83. — Hag.! Syn., 313.

Hab. Para, Brazil.

2. Zonophora semilibera, ♂.

Diaphlebia semilibera Selys, Syn. Addit., II, 34, 83 bis.

Hab. Amazon. Unknown to me.

3. Zonophora Batesi, ♂.

Zonophora Batesi Selys, Syn. Addit., II, 35, 82 bis.

Hab. Fonte Boa, Upper Amazon. Unknown to me.

4. Zonophora campanulata, ♂.

Diastatomma campanulata Burm.! Handb., II, 833, 4.

Zonophora campanulata Selys! Monogr., 234, 84, pl. 13, f. 1; Syn., 61, 82. — Hag.! Syn., 313.

Hab. Brazil.

5. Zonophora Calippus, ♂, ♀.

Zonophora Calippus Selys, Syn. Addit., II, 36, 82 ter.

Hab. Santarem, Amazon. Unknown to me.

CYCLOPHYLLA.

1. Cyclophylla diphylla, ♂.

Cyclophylla diphylla Selys! Monogr., 217, 77, pl. 12, f. 1; Syn., 57, 76. — Hag.! Syn., 313.

Hab. Brazil.

3. Cyclophylla gladiata, ♂.

Cyclophylla gladiata Selys! Monogr., 219, 78, pl. 12, f. 3; Syn., 58, 77; Addit., III, 38, 77. — Hag.! Syn., 313.

Hab. Pernambuco, Rio Janeiro, Brazil.

3. Cyclophylla signata, ♂, ♀.

Cyclophylla signata Selys! Monogr., 220, 79, pl. 12, f. 4; Syn., 58, 78. — Hag.! Syn., 313.

Hab. Brazil; Venezuela.

4. Cyclophylla sordida, ♂.

Cyclophylla sordida Selys! Monogr., 223, 80; Syn., 59, 57. — Hag.! Syn., 313.

Hab. Brazil.

5. Cyclophylla Ophis, ♂.

Cyclophylla Ophis Selys, Syn. Addit., II, 30, 77 bis.

Hab. Rio Tapajos, Amazon. Perhaps a race of *C. sordida*; unknown to me.

6. Cyclophylla Andromeda, ♀.

Cyclophylla Andromeda Selys, Syn. Addit., II, 31, 78 bis.

Hab. Caripi, Amazon. One female; unknown to me.

7. Cyclophylla Pegasus, ♂, ♀.

Cyclophylla Pegasus Selys, Syn. Addit., 32, 79 quart.

Hab. Rio Tapajos, Amazon. Unknown to me.

I possess two species of this genus from Cordova, Argentine Republic, but the single specimens of each are imperfect.

Hagenius.

1. Hagenius brevistylus. (cf. N. America.)

Hab. Columbia.

Ictinus.

1. Ictinus Latro, ♂, ♀.

Ictinus Latro Erichson! Schomburgh Reise, III.

Cacus Latro Selys! Monogr., 294, 102, pl. 16, f. 1; Syn., 78, 100.

Hab. British Guiana and Manilla.

Cordulegaster.

1. Cordulegaster diastatops, ♂, ♀.

Thecaphora diastatops Selys! Monogr., 320, 105, pl. 16, f. 4; Syn., 82, 102. — Hag. Syn., 313.

Hab. Columbia.

Petalia.

1. Petalia punctata, ♂, ♀.

Petalia punctata Selys! Monogr., 353, 117, pl. 18, f. 8; Syn., 90, 114; Addit., II, 41, 114. — Hag.! Syn., 313.

Hab. Ouchacay, Chili.

2. Petalia stictica, ♂.

Phyllopetalia stictica Selys! Monogr., 357, 118, pl. 18, f. 6; Syn. Addit., I, 24, 114 bis. — Hag.! Syn., 313.

Hab. Valdivia, Chili.

3. Petalia apicalis, ♂.

Phyllopetalia apicalis Selys! Monogr., 359, 119, pl. 18, f. 7; Syn. Addit., I, 24, 114 ter. — Hag. Syn., 313.

Hab. Valdivia, Chili.

4. Petalia pestilens, ♂.

Hypopetalia pestilens M'Lachl., Tr. Ent. Soc. Lond., 1870, 171. — Selys, Syn. Addit., III, 45, 114 quart.

Hab. Chili. Unknown to me.

5. Petalia ? pustulosa, ♀.

Allopetalia pustulosa Selys, Syn. Addit., III, App. 67, 114 quint.

Hab. Bogota, New Granada. Unknown to me.

Allopetalia reticulosa Selys, described as a race of *P. pustulosa*, is an Æschna; the type is in my collection.

Phenes.

1. Phenes raptor, ♂, ♀.

Phenes raptor Ramb.! 176, 1. — Gay Chili, VI, 115, pl. 1, f. 6. — Selys! Monogr., 377, 123, pl. 19, f. 4; Syn., 93, 117. — Hag. Syn., 313.

Hab. Chili.

Subfamily CORDULINA.

Macromia.

1. Macromia cingulata, ♀.

Ramb., Neuropt.! 137, 1. — Hag. Syn., 133, 2. — Selys, Syn. Cordul., 104, 66.

Hab. N. America. Rambur's type is the only known specimen.

2. Macromia pacifica, ♂, ♀.

Hag. Syn! 133, 4. — Selys, Syn. Cordul., 105, 67.

Hab. N. America; Pacific Survey, Lat. 38°; Waco, Texas, May 25; Dallas, N. Texas.

3. Macromia annulata, ♂, ♀.

Hag. Syn.! 132, 2. — Selys, Syn. Cordul., 107, 68.

Macromia flavipennis Walsh, Proc. Acad. Philad., 1862, 398, variety.

Hab. Pecos River, Western Texas; Des Plaines River, near Chicago, Ill. (the variety).

4. Macromia illinoensis, ♂, ♀.

Walsh, Proc. Acad. Philad.! 1862, 397. — Selys, Syn. Cordul.! 109, 69.

Hab. N. Hampshire; Wood's Hole, Mass., August; Pennsylvania; Knoxville, Tennessee; Illinois.

5. Macromia magnifica, ♂, ♀.

Selys, Syn. Cordul., Addit., 11, 70 bis.

Hab. California. Not known to me.

6. Macromia transversa, ♂, ♀.

Libellula transversa Say! Journ. Acad., VIII, 19, 3.

Epophthalmia cinnamomea Burm.! Handb., II, 845, 2.

Didymops Servillii Ramb.! Neur., 142, 1.

Didymops transversa Hag. Syn., 135, 1; Stett. Z., XXIV, 374, 58.

Macromia transversa Selys, Syn. Cordul.! III, 70. — Hag., Proc. Bost. Soc. Nat. Hist., XV, 268, 22; XVI, 359, 20.

Hab. Vermont; Milton and Stow, Mass., Aug. 30; Cambridge, July; New York; Pennsylvania; Washington, D. C.; South Carolina; Georgia; Kentucky; Detroit River, Michigan.

Nympha described by A. S. Packard, First Ann. Rep. Ins. Mass., 1871, p. 319, pl. I, f. 11, and in the third edition of his Guide.

7. Macromia tæniolata, ♂, ♀.

Macromia tæniolata Ramb.! Neur., 139, 3. — Hag. Syn., 132, 1; Stett. Z., XXIV, 374, 56; Proc. Bost. Soc. Nat. Hist., XVI, 359, 19.

Epophthalmia tæniolata Selys, Syn. Cordul.! 90, 57.

Hab. Philadelphia, Pa.; Maryland; Georgia, June 20.

EPITHECA.

1. Epitheca obsoleta, ♂, ♀.

Libellula obsoleta Say! Journ. Acad. Philad., VIII, 28, 17.

Libellula polysticta Burm.! Handb., II, 856, 53.

Cordulia molesta Walsh! Proc. Ent. Soc. Phil., I, 254.

Epithera ? obsoleta Selys, Syn. Cordul.! 45, 25.— Hag., Proc. Bost. Soc. Nat. Hist., XV, 269, 24.

Didymops obsoleta Hag. Syn., 136, 2.

Hab. Milton, Mass.; Indiana; Rock Island, Ill.; New Orleans.

Only three specimens, the types of Say, Burmeister and Walsh, are known; that of the latter was burned in the Chicago fire.

2. Epitheca procera, ♂? ♀.

Epitheca procera Selys, Syn. Cordul., 51, 29.

Cordulia procera Hag. Syn., 138, 6. (No description.)

Hab. N. America.

I have seen only the female type in Selys' collection; perhaps the male, Collection British Museum, does not belong to this species.

3. Epitheca linearis, ♂, ♀.

Cordulia linearis Hag.! Syn., 137, 2.

Epitheca linearis Selys, Syn. Cordul.! 52, 30. — Hag., Proc. Bost. Soc. Nat. Hist., XVI, 360, 23.

Hab. N. Illinois; St. Louis, Mo.; Pennsylvania.

4. Epitheca filosa, ♂, ♀.

Cordulia filosa Hag.! Syn., 136, 1.

Epitheca filosa Selys, Syn. Cordul.! 53, 21. — Hag., Proc. Bost. Soc. Nat. Hist., XVI, 360, 22.

Hab. Charles Co., Maryland; Georgia.

5. Epitheca tenebrosa, ♂, ♀.

Libellula tenebrosa Say, Journ. Acad., Philad., VIII, 19, 4.

Cordulia tenebrosa Hag. Syn., 137, 3. (From the description of Say.)

Cordulia tenebrica Hag. Syn., 138, 11. (No description.)

Epitheca tenebrosa Selys, Syn. Cordul.! 55, 34.

Hab. Nova Scotia; N. Jersey, June; Maryland, August; Indiana; N. Illinois (Kennicott), quoted with a ? from Rock Island, Ill., by Walsh, Proc. Acad. Philad., 1862, 402.

6. Epitheca elongata, ♂, ♀.

Cordulia elongata Scudder! Proc. Bost. Soc. Nat. Hist., X, 218. — Hag., ibid, XV, 377, 9.

Cordulia saturata Hag. Syn., 138, 12. (No description.)

Epitheca elongata Selys, Syn. Cordul.! 58, 55.

Hab. Hermit Lake, White Mountains, N. H., end of August; Plymouth, N. H., July 16; Nova Scotia; Upper Wisconsin River.

7. Epitheca Walshii, ♂.

Cordulia Walshii Scudder! Proc. Bost. Soc. Nat. Hist., X, 217. — Hag., ibid, XV, 377, 8.

Epitheca Walshii Selys, Syn. Cordul.! 59, 36.

Hab. The Glen, White Mountains, N. H., August 20–28.

Only two males, the types of Mr. Scudder, are known.

8. Epitheca semicircularis, ♂, ♀.

Epitheca semicircularis Selys, Syn. Cordul.! 61, 37. — Hag., Hayden's Rep., 1873, 590.

Hab. Gulf of Georgia; Victoria, Vancouver Island, July; Colorado, on Twin Lake and Arcade River, August 1–16; Pacific slope, August 16–September 10; Ogden, Utah.

9. Epitheca forcipata, ♂, ♀.

Cordulia forcipata Scudder! Proc. Bost. Soc. Nat. Hist., x, 216; xi, 300. — Hag., ibid, xi, 294; ibid, xv, 376, 6.

Cordulia chalybea Hag. Syn., 138, 7. (No description.)

Epitheca forcipata Selys, Syn. Cordul.! 61, 38.—Hag., Proc. Bost. Soc. Nat. Hist., xv, 268, 23.

Hab. The Glen, White Mountains, N. H., July 26; Maine; Nova Scotia; Fort Resolution, Hudson's Bay Territory.

10. Epitheca septentrionalis, ♂, ♀.

Cordulia septentrionalis Hag. Syn., 139, 14.

Cordulia Richardsoni Hag.! Syn., 138, 9. (No description.)

Epitheca septentrionalis Selys, Syn. Cordul.! 64, 40.

Hab. Labrador; Fort Simpson, Mackenzie River, Hudson's Bay Territory.

11. Epitheca Franklini, ♀.

Cordulia Franklini Hag.! Syn., 138, 8.

Epitheca septentrionalis Selys, Syn. Cordul., 64, 40; Addit., 9, 40. (partim.)

Hab. Fort Resolution, Hudson's Bay Terr.; Saskatchewan River.

12. Epitheca Hudsonica, ♂, ♀.

Epitheca Hudsonica Selys, Syn. Cordul.! 67, 42.

Hab. Fort Resolution, Hudson's Bay Territory.

13. Epitheca cingulata, ♂, ♀.

Cordulia cingulata Hag.! Syn., 138, 10. (No description.)

Epitheca cingulata Selys, Syn. Cordul.! 68, 43; Addit., 10, 43.

Hab. Hopedal, Labrador; New Foundland; White Mountains, N. Hampshire.

The male is not yet described; according to a communication from Baron De Selys Longchamps, it is related to the male of *E. tenebrosa* by the inferior appendage, which is furcate and recurved.

14. Epitheca albicincta, ♂, ♀.

Epophthalmia albicincta Burm.! Handb., ii, 847, 8.

Cordulia albicincta Hag.! Syn., 138, 13.

Cordulia eremita Scudd.! Proc. Bost. Soc. Nat. Hist., x, 215; xi, 300. — Hag., ibid, xi, 294; ibid, xv, 376, 5.

Epitheca albicincta Selys, Syn. Cordul.! 69, 44.

Hab. Labrador; Hermit Lake, N. H., August 11–25; Mount

Washington, N. H., July 11; Waterville, N. H., July 15; Fort Yukon, Alaska, June 25.

15. Epitheca nasalis, ♀.

Epitheca nasalis Selys, Syn. Cordul., Addit., 10, 44 bis.

Hab. N. America. Unknown to me.

Cordulia.

1. Cordulia libera, ♂, ♀.

Cordulia libera Hag. Syn., 137, 5 (no description). — Selys, Syn. Cordul.! 29, 13.

Hab. Canada; Detroit, Mich., June 7.

2. Cordulia lepida, ♂, ♀.

Cordulia lepida Selys, Syn. Cordul.! 30, 14. — Hag., Proc. Bost. Soc. Nat. Hist., xv, 270, 27.

Hab. Brookline, Natick, Stow, Cambridge, July, Mass.; Hammond's Pond, Conn., June 11–July 8; Albany, New York; New Jersey; Portland, Maine; Maryland.

I possess the nympha raised by Mr. K. T. Jones.

3. Cordulia Shurtleffii, ♂, ♀.

Cordulia Shurtleffii Scudd.! Proc. Bost. Soc. Nat. Hist., x, 217.— Hag., ibid, xv, 377, 7. — Selys, Syn. Cordul.! 31, 15.

Cordulia bifurcata Hag.! Syn., 137, 4. (No description.)

Hab. Fort Resolution and Saskatchewan, Hudson's Bay Territory; Canada; Nova Scotia; Hermit Lake, White Mountains, N. H., August 11–25.

The specimen from Ft. Yukon, Alaska, quoted as *C. Shurtleffii* Dall, belongs to a different species.

4. Cordulia spinigera, ♂, ♀.

Cordulia spinigera Selys, Syn. Cordul., 35, 19; Addit., 9, 19.

Hab. Canada; Victoria, Vancouver's Island, July; Detroit, Mich., June 7; Georgia.

5. Cordulia cynosura, ♂, ♀.

Libellula cynosura Say! Journ. Acad. Philad., viii, 30, 19.

Cordulia cynosura Selys, Syn. Cordul.! 36, 20. — Hag., Bost. Soc Nat. Hist., xv, 270, 26; xvi, 360, 25.

Epophthalmia lateralis Burm.! Handb., ii, 847, 7.

Cordulia lateralis Hag.! Syn., 139, 15. — Hag., Stett. Z., xxiv, 374, 61; Proc. Bost. Soc. Nat. Hist., xvi, 360, 25. — Walsh, Proc. Acad. Philad.! 1862, 400, 402.

Hab. Brookline, Mass.; Maine, August; Detroit, Mich., June 7; Rock Island, Ill.; Ohio; Philadelphia, Pa.; Georgia; Louisiana; Florida, March.

Variety *Cordulia basiguttata* Selys, Syn. Cordul.! 37, 20.

Hab. Canton, Mass., June 21; Maine; Florida.

The nympha, raised by Dr. A. S. Packard, is described, 18th Rep. Board of Agric., Mass., 1871, p. 379, pl. I, f. 10, and again in his Guide, 3d Edit.

6. Cordulia semiaquea, ♂, ♀.

Libellulia semiaquea Burm.! Handb., II, 849, 61.

Tetragoneuria semiaquea Hag.! Syn., 140, 1.—Hag., Stett. Z., XXIV, 374, 62.

Cordulia semiaquea Selys, Syn. Cordul.! 38, 21.—Hag., Proc. Bost. Soc. Nat. Hist., XV, 270, 26; XVI, 360, 26.

Tetragoneuria diffinis Hag.! Syn., 141, 3. (No description.)

Hab. Nova Scotia (Selys); Massachusetts; Savannah, Georgia; South Carolina; Washington, D. C.; Florida.

Variety *Cordulia complanata* Ramb.! Neur., 145, 2.—Selys, Syn. Cordul., 39, 21.

Hab. Probably Florida.

C. cynosura and *C. semiaquea* belong probably to the same species as varieties.

7. Cordulia costalis, ♂, ♀.

Cordulia costalis Selys, Syn. Cordul., 39, 22; Addit., 9, 22.

Tetragoneuria costalis Hag., Syn., 141, 4 (no description).—Stett. Z., XXIV, 374, 63; Proc. Bost. Soc. Nat. Hist., XVI, 360, 27.

Cordulia nov. spec. Hag., Stett. Z., XXIV, 374, 60.—Proc. Bost. Soc. Nat. Hist., XVI, 360, 24. (After the figures in Abbot's Mss.)

Hab. Georgia. Unknown to me.

8. Cordulia Uhleri, ♂, ♀.

Cordulia Uhleri Selys, Syn. Cordul.! 40, 23.—Hag., Proc. Bost. Soc. Nat. Hist., XV, 269, 25.

Hab. Stow, Mass.; New Jersey; Orono, Maine.

Only four specimens are known.

9. Cordulia princeps, ♂, ♀.

Epitheca princeps Hag.! Syn., 134, 1.—Hag., Stett. Z., XXIV, 374, 57; Proc. Bost. Soc. Nat. Hist., XVI, 359, 21.—Walsh! Proc. Acad. Philad., 1862, 400.

Cordulia princeps Selys, Syn. Cordul.! 41, 24.

Hab. Pecos River, Western Texas, July 15–Aug. 7; Georgia, May 7; Des Plaines River, Ill.; Maryland; Detroit, Mich., transforming July 3; New Haven, Conn.

The variety *C. regina* Selys! Syn. Cordul., 43, 24, I have seen from Georgia, Connecticut, Michigan.

I have two species, probably new, a male from Maine, related to *E. elongata*, and a female from Fort Yukon, Alaska, related to *C. albicincta*, represented only by a single specimen, and not yet described.

Cordulina from South America.

CORDULIA.

1. Cordulia sericea, ♂, ♀ (?)

Cordulia sericea Selys, Syn. Cordul., 28, 12.

Hab. Para, Brazil, November. Unknown to me.

2. Cordulia tomentosa, ♂.

Libellula tomentosa Fabr., Ent. Syst., II, 381, 34.

Cordulia tomentosa Hag. Syn., 315. — Selys, Syn. Cordul, 34, 17.

Hab. America.

Only the typical specimen (Banks' collection), in bad condition, is known. May not *L. tomentosa* be identical with *C. villosa* ?

3. Cordulia villosa, ♀.

Cordulia villosa Ramb., Neur., 144, 1. — Hag. Syn., 315. — Selys, Syn. Cordul.! 34, 18. — Gay, Faun. Chili, VI, 113, pl. 2, f. 5.

Hab. Chili, San Jago, Valparaiso.

GOMPHOMACROMIA.

1. Gomphomacromia androgynis, ♂, ♀.

Gomphomacromia androgynis Selys, Syn. Cordul., 76, 48.

Hab. Minas Geraes, Brazil. Not known to me.

2. Gomphomacromia setifera, ♂.

Cordulia setifera Hag.! Syn., 315. (No description.)

Cordulia valga Hag.! Syn., 315. (No description.)

Gomphomacromia setifera Selys, Syn. Cordul., 77, 49.

Hab. Rio Janeiro, New Fribourg, Brazil.

3. Gomphomacromia Batesi, ♂.

Gomphomacromia Batesi Selys, Syn. Cordul., 78, 50.

Hab. St. Paulo, Upper Amazon, Brazil.

4. Gomphomacromia paradoxa, ♂, ♀.

Cordulia Chilensis Hag.! Syn., 315. — Foerhdl., Dansk. V. S., 1855, 121. (No description.)

Chlorophysa Putzeysii Selys, Mss.

Gomphomacromia paradoxa Brauer, Verhdl. Bot. Zool. Ver. Wien., XIV, 163. — Reise d. Novara. Neur., 81, pl. 2, f. 5.

Hab. Chili; Quillota; Salto-Grande, Brazil. Male.

5. Gomphomacromia Volxemi, ♀.

Gomphomacromia Volxemi Selys, Syn. Cordul. Addit., 10, 49 bis.

Hab. Carrancas, Minas, Brazil, November. Unknown to me.

ÆSCHNOSOMA.

1. Æschnosoma elegans, ♀.

Æschnosoma elegans Selys, Syn. Cordul., 85, 54.

Hab. Amazon, Altar do Chao, October 30. One specimen; unknown to me.

2. Æschnosoma forcipula, ♂, ♀.

Cordulia forcipula Hag.! Syn. 315. (No description.)

Æschnosoma forcipula Selys, Syn. Cordul., 86, 55.

Hab. Brazil, Para; Upper Amazon, Ega and St. Paulo, November; Bahia (?)

3. Æschnosoma rustica, ♂.

Cordulia rustica Hag.! Syn., 315. (No description.)

Æschnosoma rustiça Selys, Syn. Cordul, 87, 56.

Hab. Bahia, Brazil.

Subfamily LIBELLULINA.

PANTALA.

1. Pantala flavescens, ♂, ♀.

Libellula flavescens Fabr.! Ent. Syst. Suppl., 285, 18, 19, male young. — Selys! Sagra. Ins. Cub., 443. — Hag.! Foerhdl. Dansk. V. S., 1855, 124.

Libellula viridula Palisot de Beauv., Ins. Afr. Neur., 69, pl. 3, f. 4. —Savigny, Descript. de l'Egypte Neur., pl. 1, f. 4. — Ramb., Neur., 38, 10.

Libellula analis Burm.! Handb., II, 852, 23, young male.

Libellula terminalis Burm.! Handb., II, 852, 24, male.

Libellula Sparshallii Curtis, Guide, 162, 5. — Selys, Monogr. Lib., 36. — Revue des Odon., 322.

Pantala flavescens Hag.! Syn., 142, 1. — Stett. Z., xxviii, 1; ibid, xxiv, 374, 64. — Overs., Dansk. Vid. S. Forhdl., 1855, 122; Proc. Bost. Soc. Nat. Hist., xi, 291; xvi, 360, 28.

Hab. Georgia, July 8; Maryland; St. Louis, Missouri; Dallas, Texas; Matamoras, Matzatlan, Mex., October; Cardenas, Cuba, August–October; Martinique; St. Thomas; Barbados; Hayti; South America; in Asia, Africa, Oceanica; perhaps in Europe.

2. Pantala Hymenæa, ♂, ♀.

Libellula Hymenœa Say, Journ. Acad. Philad., viii, 18, 1.

Pantala Hymenœa Hag.! Syn., 142, 2; Stett. Z., xxviii, 217, 2; Proc. Bost. Soc. Nat. Hist., xi, 291. — Walsh! Proc. Acad. Philad., 1862, 400.

Hab. Indiana; Illinois; Pecos River, Western Texas, June 4–August 14; Matamoras, Matzatlan, Mex., October; Cardenas, Cuba, October.

Tholymis.

1. Tholymis citrina, ♂, ♀.

Tholymis citrina Hag.! Stett. Z., xxviii, 218, 1; Proc. Bost. Soc. Nat. Hist., xi, 291.

Hab. Cardenas, Cuba, July; Panama; Para, Brazil.

Formerly this species was united with *L. Tillarga* Fabr.; now I possess both sexes of the three related species. *Th. citrina* I believe to be a different species; of the two others I am not so sure; perhaps they may be only races.

Tramea.

1. Tramea carolina, ♂, ♀.

Libellula carolina L., Centur. Ins., 28, 85; Am. Acad., vi, 441, 85. — Syst. Nat., ed. xii, I, 904, 17; Gmelin, ed. xiii, V, 2624, 17. — Drury, Ins., i, 113, pl. 48. f. 1. — Fabr., Syst. Ent., 424, 23; Spec. Ins., i, 524, 30; Mant. Ins., i, 338, 33; Entom. Syst., ii, 382, 41. — Burm.! Handb., ii, 852, 26. — Say, Journ. Acad. Philad., viii, 19, 2. — Ramb.! Neur., 32, 1.

Tramea carolina Hag.! Syn., 143, 1; Stett. Z., xxiv, 374, 65; ibid, xxviii, 222, 1; Proc. Bost. Soc. Nat. Hist., xi, 291; xv, 263, 1; ibid, xvi, 361, 29.

Hab. Natick, Mass., June 4; New York; Bergen Hill, N. Jersey; Georgia; Florida; Knoxville, Tennessee.

The specimens quoted in my synopsis from Cuba, Guadeloupe, and St. Thomas, belong to *T. onusta*.

2. Tramea onusta, ♂, ♀.

Tramea onusta Hag.! Syn., 144, 2; Stett. Z., XXVIII, 222, 2; Proc. Bost. Soc. Nat. Hist., XI, 292.

Libellula carolina Selys! Sagra Ins. Cuba, 440.

Hab. Pecos River, Western Texas, Jan. 4–August 13, Dallas, N. Texas; Matamoras, Matzatlan, Mexico, October; Key West, Florida, January–March; Cuba; St. Thomas; Guadeloupe; Panama. In Cuba, only one female has yet been found by Mr. Poey.

3. Tramea chinensis, ♀, ♂.

Libellula chinensis De Geer, Mém., III, 556, pl. 25, 1.—Burm., Handb., II, 852, 27.—Hag.! Syn., 144, 2.

Libellula Virginia Rbr.! 33, 2.

Hab. Carolina (Vienna Museum); North America (Paris Museum; Serville collection).

This species, from China and Madras, is to be considered as very doubtfully belonging to N. America.

4. Tramea lacerata, ♂, ♀.

Tramea lacerata Hag.! Syn., 145, 4.—Walsh! Proc. Acad. Philad., 1862, 400.

Hab. Chicago, North and South Illinois; Pecos River, Western Texas, July 10; Waco, Texas, July 7; Maryland; Matamoras, Mexico; Detroit, Michigan, June.

5. Tramea abdominalis, ♂, ♀.

Libellula abdominalis Ramb., Neur., 37, 8.

Libellula basalis Selys! Sagra Ins. Cuba, 441.

Tramea abdominalis Hag.! Syn., 145, 5; Stett. Z., XXVIII, 223, 3; Proc. Bost. Soc. Nat. Hist., XI, 292.

Tramea insularis Scudd.! Proc. Bost. Soc. Nat. Hist., X, 191. (In part, female.)

Hab. Nantucket Island, Mass., August 30; Key West, Florida, March; Mexico; Cardenas, Cuba, April and October; Hayti.

This species migrates in large flocks in March, in Cuba.

6. Tramea insularis, ♂, ♀.

Tramea insularis Hag.! Syn., 146, 6; Stett. Z., XXVIII, 98 and 224, 4; Proc. Bost. Soc. Nat. Hist., XI, 292; ibid., XV, 374, 5.—Scudd. Proc. Bost. Soc. Nat. Hist., X, 191; XI, 299 (in part, male).—Uhler! ibid., XI, 295.

Hab. Cardenas, Cuba, in July–October; Key West, Florida, February; Hayti, May.

T. insularis and *T. abdominalis* are very nearly related, and united by Messrs. Poey, Gundlach, Scudder and Uhler. I have pointed out the differences, Stett. Z., XXVIII, 224.

7. Tramea australis, ♂, ♀.

Tramea australis Hag.! Stett. Z., XXVIII, 229, 7; Proc. Bost. Soc. Nat. Hist., XI, 292.

Hab. Cardenas, Cuba, July.

I have seen only the female; the male is described from a note by Mr. Gundlach. I suppose my *Tr. Iphigenia* from Venezuela, New Granada, to be a different species. *T. australis* is an aberrant species, perhaps belonging to Lepthemis, near *L. cardinalis*. New specimens will decide the question.

8. Tramea Marcella, ♂, ♀.

Libellula Marcella Selys! Sagra Ins. Cuba, 452. (No description.)

Tramea simplex Hag.! Syn., 146, 7.

Tramea Marcella Hag.! Stett. Z., XXVIII, 227, 5; Proc. Bost. Soc. Nat. Hist., XI, 292.

Hab. Cardenas; Cuba, November; Brazil, New Grenada, Turbo; Tampico, Mazatlan, Mexico, October.

9. Tramea simplex, ♂, ♀.

Libellula simplex Ramb.! Neur., 121, 128.—Selys! Sagra Ins. Cuba, 452.

Tramea simplex Hag.! Stett. Z., XXVIII, 228, 6; Proc. Bost. Soc. Nat. Hist., XI, 292.

Hab. Cardenas, Cuba.

10. Tramea? balteata, ♂, ♀.

Tetragoneuria balteata Hag.! Syn., 140, 1.

Hab. Pecos River, Western Texas, August; Key West, Florida, February; Cuba.

An aberrant species; perhaps not belonging to Tramea.

Celithemis.

1. Celithemis Eponina, ♂, ♀.

Libellula Eponina Drury, II, 86, pl. 47, f. 2. — Fabr., Ent. Syst., II, 382, 39. — Coquebert, Icon., 27, pl. 7, f. 1. — Burm., Handb., II, 853, 30. — Ramb., Neur., 45, 20. — Selys! Sagra Ins. Cuba, 442. — Oliv., Enc. meth., VII, 572, 19. — Say, Journ. Acad. Philad., VIII, 24, 11.

Libellula Camilla Ramb.! Neur., 46, 21.

Libellula Lucilla Ramb., Neur., 46, 22.

Celithemis Eponina Hag.! Syn., 147, 1; Stett. Z., XXVIII, 231, 1; ibid., XXIV, 374, 66; Proc. Bost. Soc. Nat. Hist., XI, 292; XV, 263, 2; XVI, 361, 30. — Walsh! Proc. Acad. Philad., 1862, 400.

Hab. United States, east of Rocky Mountains; Saugus, Natick, Massachusetts, July, around Boston August 1–15; N. Jersey; Pennsylvania; Virginia; Carolina; Maryland; Georgia, August; St. Augustine and Key West, Florida; New Orleans, La.; Kentucky; St. Louis, Mo.; Rock Island, Ill.; Cuba.

2. Celithemis Elisa, ♂, ♀.

Diplax Elisa Hag.! Syn., 182, 15; Stett. Z., XXIV, 375, 80; ibid., XXVIII, 232; Proc. Bost. Soc. Nat. Hist., XV, 266, 13; XVI, 363, 44.

Celithemis Elisa Walsh! Proc. Acad. Philad., 1862, 400.

Hab. Natick, Massachusetts, July 17 – August 19, Cambridge, May; New Jersey; Detroit, Mich., June; Chicago, Ill.; Georgia, June 9, rare; Canada.

I cannot yet decide if Mr. Walsh is right in referring this species to Celithemis. *C. superba* Syn., 148, 2 belongs to

ERYTHRODIPLAX Brauer.

1. Erythrodiplax superba, ♂, ♀.

Celithemis superba Hag.! Syn., 148, 2.

Hab. Oaxaca, Tampico, Matzatlan, Mexico, October.

PLATHEMIS.

1. Plathemis trimaculata, ♂, ♀.

Libellula trimaculata DeGeer, Mém., III, 556, 2, pl. 24, f. 23.—Fabr., Ent. Syst., II, 374, 5. — Burm.! Handb., II, 861, 78. — Ramb.! Neur., 52, 228.

Libellula Lydia Drury, Ins., I, 112, pl. 47, f. 4. — Say, Journ. Acad. Philad., VIII, 20, 5 (male).

Plathemis trimaculata Hag.! Syn. 149, 1; Stett. Z., XXVI, 374, 67; Proc. Bost. Soc. Nat. Hist., XV, 263, 3; ibid., XVI, 361, 31.—Walsh! Proc. Acad. Philad., 1862, 400.

Hab. Everywhere east of Rocky Mountains; Ontario, Canada; Maine; Massachusetts; N. York; N. Jersey; Pennsylvania; Maryland; Washington, D. C.; Georgia, July 18; Kentucky, June; Ohio;

Illinois, May to September; Michigan, June 17; Dallas and Waco, Texas, May 25 – October 2; New Orleans.

In my Synopsis North California is quoted; probably the specimen, no longer in my hands, belonged to *P. subornata*.

2. Plathemis subornata, ♂, ♀.

Plathemis subornata Hag.! Syn., 149, 2.

Hab. Pecos River, Western Texas, July 7; N. Mexico, June 30; S. Diego, California, April.

Libellula.

1. Libellula forensis, ♂, ♀.

Libellula forensis Hag.! Syn., 154, 9; Hayden's Rep., 1873, 585; ibid., Rep., 1872, 728.

Hab. California; Victoria, Vancouver's Island, July; British Columbia; Yellowstone; Montana; Leave Spring, Arizona.

2. Libellula nodisticta, ♂, ♀.

Libellula nodisticta Hag.! Syn., 151, 3; Hayden's Rep., 1872, 727; Rep., 1873, 583.

Hab. Mexico; Yellowstone; Montana.

3. Libellula quadrimaculata, ♂, ♀.

Libellula quadrimaculata Linné, S. N., XII, I, 901, 1.—Fabr.—Burm.—Ramb.—Selys, Revue Odon., 72 (with synonymy complete).—Hag., Syn. ! 150, 1; Hayden's Rep., 1873, 583; Proc. Bost. Soc. Nat. Hist., XV, 264, 5.—Walsh! Proc. Acad. Philad., 1862, 400.

Libellula quadripunctata Fabr.! Ent. Syst., II, 375, 5.

Libellula ternaria Say! Journ. Acad. Philad., VIII, 21, 7 (in part male).

Hab. Massachusetts, July; Detroit, Michigan, June 7; Rock Island, Ill.; Wisconsin; Snake River, Idaho; Ogden, Utah; Bridger Basin, Wyoming; Ontario, Canada; Saskatchewan River, Hudson's Bay Territory. Migrates in immense flocks. Common in Europe, N. Asia to Kamschatka.

Race *L. prænubila*, in Massachusetts and Michigan.

4. Libellula semifasciata, ♂, ♀.

Libellula semifasciata Burm.! Handb., II, 862, 20.—Hag.! Syn., 151, 2; Stett. Z., XXIV, 374, 68; Proc. Bost. Soc. Nat. Hist., XV, 264, 6; ibid., XVI, 361, 32.—Walsh! Proc. Acad. Philad., 1862, 400.

Libellula maculata Rbr.! Neur., 55, 31.

Libellula ternaria Say! Journ. Acad. Philad., VIII, 21, 7.

Hab. Manchester, Massachusetts, June 20–July 6, Cambridge, Stow; New York, June; New Jersey; Maryland; Carolina; Georgia, April 2–June 29, not very common; Dallas, Texas; Florida; Detroit, Mich., July 17; Des Plaines River, Ill.

5. Libellula exusta, ♂, ♀.

Libellula exusta Say! Journ. Acad. Philad., VIII, 29, 18; Hag., Syn., 155; Proc. Bost. Soc. Nat. Hist., XV, 265, 7.

Libellula Julia Uhler, Proc. Acad. Philad., 1857, 88, 5; Hag., Syn., 153, 7; Stett. Z., XXVIII, 92.

Hab. Sutton, Worcester, Vaughan's Pond, Massachusetts, July 9, Hammond Pond, Cambridge, June 11; Norway, Maine; Racine, Wisconsin; Lake Winnipeg; Fort Steilacoom, Puget Sound; Victoria, Vancouver's Island, July; Ontario, Canada.

The existence of the type of Say, and its identity with the type of *L. Julia*, stated by Mr. Uhler, secures this species. The typical *L. exusta* has two pale bands on the thorax, which are not bluish in the adult; but I am unable to discover specific characters, and consider both forms as belonging to the same species. Even *L. deplanata* seemed to be a dwarfish southern form, but there are differences in the genital parts, probably important enough to separate the two species. A full description of *L. Julia*, ♂, ♀, by Mr. Uhler, is given, Stett. Z., XXVIII, 92.

6. Libellula deplanata, ♂, ♀.

Libellula deplanata Ramb.! Neur., 75, 61.—Hag., Syn., 154, 10; Stett. Z., XXIV, 374, 70; Proc. Bost. Soc. Nat., XV, 265, 6; XVI, 361, 34.

Hab. Pennsylvania; Georgia.

7. Libellula pulchella, ♂, ♀.

Libellula pulchella Drury, Ins., I, 115, pl. 48, f. 5.—Ramb.! Neur., 54, 30.—Duncan Introd., 292, pl. 29, f. 2.—Hag.! Syn., 153, 8; Stett. Z, XXIV, 374, 69; Proc. Bost. Soc. Nat. Hist., XV, 264, 4; ibid., XVI, 361, 33; Hayden's Rep., 1873, 585.—Walsh! Proc. Acad. Philad, 1862, 400.

Libellula versicolor Fabr.! Syst. Ent., 423, 17; Sp. Ins., I, 523, 22. —Mant. Ins., I, 337, 23; Ent. Syst,, II, 380, 29 (male).

Libellula bifasciata Fabr.! Syst. Ent., 421, 3; Sp. Ins., I, 520, 3; Mant. Ins., I, 336, 3; Ent. Syst. II, 374, 4 (female).—Burm.! Handb., II, 862, 81.—Blanch., Hist. Ins., 58, 9.—Say, Journ. Acad. Phil., VIII, 20, 6.

Libellula confusa Uhler! Proc. Acad. Philad., 1857, 87, 3 (teneral); Stett. Z., XXVIII, 91.

There are numerous woodcuts and descriptions of this species in American popular papers.

Hab. Ontario, Canada; Andover, Maine, July 6, Brunswick; New Hampshire; Massachusetts, common, July; New York; New Jersey; Pennsylvania; Maryland; Kentucky, May; Mississippi; Georgia, very rare; Dallas, Waco, Texas, September 4–30; Detroit, Michigan, June 17; Chicago and S. Illinois; Fort Hayes, Kansas, May 6. Only one specimen west of the Rocky Mts., from Ogden, Utah.

8. Libellula saturata, ♂, ♀.

Libellula saturata Uhler! Proc. Acad. Philad., 1857, 88, 4. — Hag.! Syn., 152, 4 (in part); Hayden's Rep., 1873, 586; Stett. Z., XXVIII, 92.

Hab. Yellowstone; Montana; Arizona, Aug. 5.

Formerly erroneously united by me with *L. croceipennis*.

9. Libellula croceipennis, ♂, ♀.

Libellula croceipennis Selys, Ann. Soc. Ent. Belg., XI; Proc., 67, 1. Hag.! Hayden's Rep., 1873, 586.

Hab. Cape San Lucas, Lower California; Tampico, Cordova, Orizaba, Vera Cruz, Tehuantepec, Mexico; Guatemala, and perhaps Columbia.

10. Libellula basalis, ♂, ♀.

Libellula basalis Say, Journ. Acad. Philad., VIII, 23, 10.

Libellula luctuosa ! Burm., Handb., II, 861, 76. — Hag., Syn., 152, 5.—Walsh, Proc. Acad. Philad., 1862, 400.

Hab. New York; New Jersey, June; Pennsylvania; Maryland; Washington, D. C.; Virginia; Detroit, Mich., June 17; Illinois; Fort Hayes, Kansas; Ontario, Canada.

11. Libellula odiosa, ♂, ♀.

Libellula odiosa Hag.! Syn., 152, 6.

Hab. Pecos River, Western Texas, July 10–Aug. 30; S. Antonio, Dallas, Waco, Texas, July 14.

Probably a race of *L. basalis*.

12. Libellula auripennis, ♂, ♀.

Libellula auripennis Burm.! Handb., II, 861, 67. — Hag.! Syn., 155, 11; Stett. Z., XXIV, 375, 71; XXVIII, 98; Proc. Bost. Soc. Nat. Hist., XI, 292; XV, 266, 9; XVI, 360, 35; XVI, 374, 6. — Scudder! Proc. Bost. Soc. Nat. Hist., X, 191.

Hab. New York; New Jersey; Maryland; Virginia; Georgia, April 20, common; Ohio; New Orleans, Louisiana; Dallas, Texas; Florida; Cardenas, October, Cienfuegos, April–July, Cuba; Isle of Pines.

13. Libellula incesta, ♂.

Libellula incesta Hag.! Syn., 155, 12.

Hab. New Hampshire, June 28; Saugus, Massachusetts, July; Carolina; Dallas, Texas.

A rare species; I have never seen the female, and only six males.

14. Libellula Lydia, ♂, ♀.

Libellula Lydia Drury, Ins., II, 85, pl. 47, f. 1.—Ramb.! Neur., 55, 32.—Oliv., Enc. Meth., VII, 570, 8.—Hag.! Syn., 155, 13; Stett. Z., XXIV, 375, 72; Proc. Bost. Soc. Nat. Hist., XVI, 361, 36.

Libellula Leda Say, Journ. Acad. Philad., VIII, 21, 8, var. *A*. (in part).

Hab. Virginia; S. Carolina; Georgia, April 20, rare; New Orleans, Louisiana; Florida; Dallas, Texas.

15. Libellula Axillena, ♂, ♀;

Libellula Axillena Westwood! Duncan Intr., 292, pl. 29, f. 1.—Hag.! Syn., 156, 14; Stett. Z., XXIV, 375, 73; Proc. Bost. Soc. Nat. Hist., XVI, 361, 37.

Libellula Lydia Ramb.! Neur., 55, 32 (in part).

Libellula Leda Say, Journ. Acad. Philad., VIII, 22, 8 (in part).

Hab. Georgia; Louisiana; Florida.

Probably a race of *L. Lydia*.

16. Libellula flavida, ♂, ♀.

Libellula flavida Ramb.! Neur., 58, 85.—Hag.! Syn., 156, 15; Hayden's Rep., 1872, 728; 1873, 587.

Hab. Pecos River, West Texas, July 9–Aug. 11; Dallas, Waco, Texas, September 9; Yellowstone; Montana.

17. Libellula composita, ♀.

Libellula composita Hag.! Hayden's Rep., 1873, 587.

Mesothemis composita Hag.! Hayden's Rep., 1872, 728.

Hab. Yellowstone. One female.

18. Libellula quadrupla, ♂, ♀.

Libellula quadrupla Say! Journ. Acad. Philad., VIII, 23, 9.—Hag. Syn.! 157, 16; Proc. Bost. Soc. Nat. Hist., XV, 266, 10; Stett. Z., XXVIII, 91.

Libellula bistigma Uhler! Proc. Acad. Philad., 1857, 87, 1 (male adult).

Libellula cyanea Fabr., Ent. Syst., 381, 36.

Hab. Milton, Cambridge, Beverly, Natick, Woburn, Massachusetts, June, July; New Jersey; Maryland.

I have no doubt that *L. cyanea* F., is this species; the only objection would be the "abdomine cylindrico" in his description; but I possess males agreeing with this character.

19. Libellula plumbea, ♂, ♀.

Libellula plumbea Uhler! Proc. Acad. Philad., 1857, 87, 2.—Hag.! Syn., 157, 17; Stett. Z., XXIV, 375, 74; XXVIII, 91; Proc. Bost. Soc. Nat. Hist., XVI, 362, 39.

Hab. New Jersey; Baltimore, Maryland, July; Georgia, April 27, common.

Perhaps this species is *Cordulia costalis* Selys from Georgia. I should be nearly sure of it, had not Baron De Selys stated that he had again examined the female type in the British Museum.

20. Libellula funerea, ♂, ♀.

Libellula funerea Hag.! Syn., 158, 18.

Hab. Acapulco, Mexico; Panama.

21. Libellula umbrata, ♂, ♀.

Libellula umbrata Linné, Syst. N., XII, I, 903, 13.—Fabr., Syst. Ent., 422, 14; Spec. Ins., I, 522, 18; Mant. Ins., I, 337, 18; Ent. Syst., II, 378, 21.—Burm., Hand., II, 856, 48.—Ramb.! Neur., 73, 58.—Selys! Sagra Ins. Cat., 448.—Hag.! Syn., 158, 19; Proc. Bost. Soc. Nat. Hist., XI, 292; Stett. Z., XXIV, 375, 75; XXIX, 274; XXX, 263; Uhler! Proc. Bost. Soc. Nat. Hist., XI, 297.

Libellula unifasciata De Geer, Mem. III, 557, 3, pl. 26, f. 4.

Libellula fallax Burm.! Handb., II, 855, 45 (teneral).

Libellula subfasciata Burm.! Hand., II, 855, 46 (male teneral).

Libellula tripartita Burm.! Handb., II, 856, 47 (male adult).

Libellula ruralis Burm.! Handb., II, 856, 49 (female).

Libellula flavicans Ramb.! Neur., 87, 79 (female).

Libellula fuscofasciata Blanch., Voy. D'Orbigny, 217, 751, pl. 28, f. 5.

Hab. Georgia? (a male from Abbot's collection; locality still doubtful); Matamoras, Mexico (one male); Cuba, migrates in June and November; Hayti, April, May in Jeremie; St. Thomas; Barbados; common in S. America.

The female with the band of the wings as in the male is very rare; I have seen three specimens from Cuba.

The race *L. tripartita* belongs to the West India Islands. There is, perhaps, a very similar but different species. Two very small females, the wings with black bands, are from Waco, Texas, July 14, and Panama; but the male from Panama has the wings colored as in *L. funerea.*

22. Libellula angustipennis, ♂, ♀.

Libellula angustipennis Ramb.! Neur., 63, 42. — Selys! Sagra Ins. Cuba, 446.—Hag.! Syn., 159, 20; Stett. Z., XXVIII, 98; Proc. Bost. Soc. Nat. Hist., XV, 374, 7. — Scudder! Proc. Bost. Soc. Nat. Hist., X, 192.— Uhler! ibid., XI, 297.

Hab. Cardenas, Cuba, July; Isle of Pines; Hayti, May.

23. Libellula vibex, ♂.

Libellula vibex Hag.! Syn., 159, 21.

Libellula merida Selys, Ann. Soc. Ent. Belg., XI, Proc., 67?

Hab. Cordova, Mexico.

I have not seen *L. merida*, but the identity is probable. Hab. Orizaba, Mexico; Merida, Venezuela.

Subgenus ORTHEMIS.

24. Libellula discolor, ♂, ♀.

Libellula ferruginea Fabr., Syst. Ent., 423, 19; Spec. Ins., I, 523, 25 (not of Entom. syst.).

Libellula discolor Burm.! Handb., II, 856, 51.— Uhler! Proc. Bost. Soc. Nat. Hist., XI, 297. — Hag.! Syn., 160, 22; Proc. Bost. Soc. Nat. Hist., XI, 292; Stett. *Z.*, XXIX, 279, 1; XXX, 263, 13.

Libellula macrostigma Rbr.! Neur., 50, 26. — Selys! Sagra Ins. Cuba, 443.

Hab. Key West, Florida; Dallas, Waco, Texas, September–October; Tampico, Matamoras, Matzatlan, Mexico, October; Central America; Cuba, July–October; Hayti, April, May; Porto Rico; St. Thomas; Barbados; Martinique; Guadeloupe; St. Croix; Jamaica; common in S. America.

LEPTHEMIS.

1. Lepthemis vesiculosa, ♂, ♀.

Libellula vesiculosa Fabr., Syst. Ent., 421, 7; Spec. Ins., I, 521, 9; Mant. Ins., I, 336, 9; Ent. Syst., II, 377, 12. — Burm., Handb.! II, 857, 54.— Ramb.! Neur., 50, 26. — Uhler! Proc. Bost. Soc. Nat. Hist., XI, 297.— Selys! Sagra Ins. Cuba, 443. — Hag.! Syn., 161, 1; Proc. Bost. Soc. Nat. Hist., XI, 292.

Libellula acuta Say, Journ. Acad. Philad., XIII, 24, 12.

Hab. Matamoras, Mazatlan, Mexico, October; Cardenas, Cuba, April; Hayti, April, May; St. Thomas; Barbados; Panama, May; St. Thomas; migrates in Cuba in June.

2. Lepthemis hæmatogastra, ♂, ♀.

Libellula hæmatogastra Burm.! Handb., II, 837, 55.—Hag.! Syn., 161, 2; Stett. Z., XXIV, 375, 76; Proc. Bost. Soc. Nat. Hist., XV, 362, 40.

Hab. Georgia (one male by Abbot; locality still doubtful); South America.

3. Lepthemis Attala, ♂, ♀.

Lepthemis Attala Hag.! Proc. Bost. Soc. Nat. Hist., XI, 292.

Libellula Attala Selys! Sagra Ins. Cuba, 445.

Libellula Mithra Selys! Sagra Ins. Cuba, 445.

Mesothemis Attala Hag., Syn., 172, 5.

Mesothemis Mithra Hag., Syn., 172, 6.—Uhler! Proc. Bost. Soc. Nat. Hist., XI, 298.

Libellula annulata Ramb., Neur., 78, 65 (in part).

Lepthemis verbenata Hag.! Syn., 162, 3.

Hab. Cuba; Hayti, May; Matzatlan, Mexico, October; South America.

4. Lepthemis herbida, ♂, ♀.

Lepthemis herbida Hag., Proc. Bost. Soc. Nat. Hist., XI, 292. (No description.)

Hab. Cardenas, Cuba, October, November.

An aberrant species; I have seen one pair.

5. Lepthemis cardinalis, ♂, ♀.

Libellula cardinalis Erichs! Schomb. Voy., III, 583.—Hag.! Syn., 316.

Hab. Panama; Guiana; Para, Brazil.

Dythemis.

1. Dythemis rufinervis, ♂, ♀.

Libellula rufinervis Burm.! Handb., II, 815, 15.

Libellula conjuncta Rbr.! Neur., 91, 84.—Selys! Sagra Ins. Cuba, 444.

Libellula vinosa Scudder! Proc. Bost. Soc. Nat. Hist., X, 192; XI, 292.

Dythemis rufinervis Hag.! Syn., 162, 1; Stett. Z, XXVIII, 98; Proc. Bost. Soc. Nat. Hist., XV, 374, 8.—Uhler! Proc. Bost. Soc. Nat. Hist., XI, 297.

Hab. Cuba; Hayti, May.

2. Dythemis velox, ♂, ♀.

Dythemis velox Hag.! Syn., 163, 2.

Hab. Pecos River, Texas, July–August; Waco, July 14–August 20.

3. Dythemis fugax, ♂, ♀.

Dythemis fugax Hag.! Syn., 163, 3.

Hab. Pecos River, Western Texas, July–August; Waco, Texas, August 1.

4. Dythemis mendax, ♂, ♀.

Dythemis mendax Hag.! Syn., 164, 4.

Hab. Pecos River, Western Texas, July; St. Antonio, Texas.

5. Dythemis præcox, Hag.! Syn., 164, 5.

Hab. Mexico.

6. Dythemis pertinax, ♂, ♀.

Dythemis pertinax Hag.! Syn., 166, 10, male.

Dythemis Sallei Selys, Ann. Soc. Ent. Belg., XI; Proc., 67? female.

Hab. Orizaba, Mexico. I have not seen *D. Sallei*; probably it belongs here.

7, 8, 9. Three new species from Waco, Texas, and Mexico; related to the foregoing ones.

10. Dythemis frontalis, ♂, ♀.

Libellula frontalis Burm.! Handb., II, 857, 56.— Selys! Sagra Ins. Cuba, 453.— Scudder! Proc. Bost. Soc. Nat. Hist., X, 193.

Dythemis frontalis Hag.! Syn., 165, 6; Stett. Z., XXVIII, 98; Proc. Bost. Soc. Nat. Hist., XI, 292; XV, 375, 9.— Uhler! Proc. Bost. Soc. Nat. Hist., XI, 298.

Hab. Cardenas, Cuba, May–June; Isle of Pines; Hayti, May.

11. Dythemis dicrota, ♂, ♀.

Dythemis didyma Hag.! Syn., 165, 8 (not Selys); Proc. Bost. Soc. Nat. Hist., XI, 292.

Hab. Cuba; Matamoras, Tampico, Mexico.

As my *D. dicrota* proved to be *Lib. didyma* Selys, I have given the name *D. dicrota* to this species.

12. Dythemis didyma, ♂, ♀.

Libellula didyma Selys! Sagra Ins. Cuba, 453.

Libellula Phryne Ramb.! Neur., 121, 127.

Dythemis dicrota Hag.! Syn., 166, 9; Proc. Bost. Soc. Nat. Hist., XI, 292.

Mesothemis Poeyi Scudder! Proc. Bost. Soc. Nat. Hist., X, 194;

XI, 300.— Hag.! Stett. Z., XXVIII, 98; Proc. Bost. Soc. Nat. Hist., XI, 292; XV, 375; 11.

Hab. Cuba; Isle of Pines.

13. Dythemis æqualis, ♂, ♀.

Dythemis æqualis Hag.! Syn., 167, 11; Proc. Bost. Soc. Nat. Hist., XI, 293.

Hab. Cardenas, Cuba, July, October; Matamoras, Mex.

14. Dythemis incrassata, ♀. Hagen (no description).

Hab. Cuba.

15. Dythemis næva, ♂, ♀.

Dythemis næva Hag.! Syn., 167, 12; Proc. Bost. Soc. Nat. Hist., XI, 293.

Hab. Cardenas, Cuba, August, September.

16. Dythemis debilis, ♂, ♀.

Dythemis debilis Hag.! Syn., 168, 13; Proc. Bost. Soc. Nat. Hist., XI, 293.

Hab. Cardenas, Cuba, August-October.

17. Dythemis exhausta, ♂, ♀.

Dythemis exhausta Hag.! Proc. Bost. Soc. Nat. Hist., XI, 293. (No description.)

Hab. Cardenas, Cuba, August-September.

Macrothemis.

1. Macrothemis Celeno, ♂, ♀.

Libellula Celeno Selys! Sagra Ins. Cuba, 454.

Macrothemis Celeno Hag.! Stett. Z., XXIX, 281, 1.

Dythemis pleurosticta Hag.! Syn., 165, 7 (in part); Stett. Z., XXVIII, 98; Proc. Bost. Soc. Nat. Hist., XI, 292; XV, 375. — Scudder! Proc. Bost. Soc. Nat. Hist., X, 194. — Uhler! Proc. Bost. Soc. Nat. Hist., XI, 298.

Hab. Cardenas, Cuba, July, October, November; Isle of Pines; St. Thomas; Hayti, April, May.

Erythemis.

1. Erythemis furcata, ♂, ♀.

Erythemis furcata Hag.! Syn., 169, 1; Proc. Bost. Soc. Nat. Hist., XI, 293.

Hab. Cuba; Tampico, Mex.; Bahia, Brazil.

2. Erythemis bicolor, ♂, ♀.

Libellula bicolor Erichs! Voy. Schomburgk, III; Stett. Z., XXX, 263, 23.

Erythemis bicolor Hag.! Syn., 169, 2.

Hab. Choco, New Grenada; S. America.

3. Erythemis cubensis, ♂, ♀.

Erythemis longipes Hag.! Syn., 169, 3 (in part).

Erythemis specularis Hag.! Stett. Z., XXVIII, 98; Proc. Bost. Soc. Nat. Hist., XI, 293; XV, 374, 4.

Macromia cubensis Scudd.! Proc. Bost. Soc. Nat. Hist., X, 190; XI, 299. — Hag.! Proc. Bost. Soc. Nat. Hist., XV, 374, 4.

Hab. Cardenas, Cuba, April, July, October; Isle of Pines.

Mesothemis.

1. Mesothemis simplicicollis, ♂, ♀.

Libellula simplicicollis Say! Journ. Acad. Philad., VIII, 28, 16.

Libellula cærulans Ramb.! Neur., 64, 44 (male). — Selys! Sagra Ins. Cuba, 448.

Libellula maculiventris Ramb.! Neur., 87, 78 (female).

Mesothemis simplicicollis Hag.! Syn., 170, 1; Stett. Z., XXIV, 375, 77; Proc. Bost. Soc. Nat. Hist., XI, 293; XV, 266, 12; XVI, 362, 41; Hayden's Rep., 1872, 728; 1873, 587. —Walsh! Proc. Acad. Philad., 1862, 400.

Mesothemis Gundlachii Scudder! Proc. Bost. Soc. Nat. Hist., X, 195, XI, 299. — Hag., Stett. Z., XXVIII, 96; Proc. Bost. Soc. Nat. Hist., XVI, 375, 12.

Hab. Natick, Massachusetts, August; N. York; N. Jersey; Philadelphia, Pa.; Dalton, Savannah, Georgia, May; Florida; Louisiana; Indiana; Rock Isl., Illinois, June; Detroit, Mich., July; Montana; Ogden, Utah (?); Pecos River, Western Texas, July; Dallas, Waco, Texas, July–September; Matamoras, Huastec, Mexico; Cardenas; Cuba, May, June; Isle of Pines.

A very common species.

2. Mesothemis collocata, ♂, ♀.

Mesothemis collocata Hag.! Syn., 171, 2; Hayden's Rep., 1873, 587.

Hab. Pecos River, Western Texas, July; Yellowstone; San Diego, California, April.

3. Mesothemis corrupta, ♂, ♀.

Mesothemis corrupta Hag.! Syn., 171, 3; Hayden's Rep., 1872, 728; 1873, 587.—Walsh! Proc. Acad. Philad., 1862, 400.

Hab. Rock Island, N. and S. Illinois; Kansas; Pecos River, West Texas, May, June; Dallas, Waco, Texas, October; Matamoras, Mexico; Foot Hills, Colorado; Montana, San José, California, November. Also in Ajan, Asia, Sea of Ochotsk.

4. Mesothemis illota, ♂, ♀.

Mesothemis illota Hag.! Syn., 172, 4; Hayden's Rep., 1873, 587.

Hab. San Diego, California, April; San Matteo, Mendocino, Gulf of Georgia; San José, March; Victoria, Vancouver's Island, July; Mexico; Yellowstone. Also in Ajan, Asia.

Perhaps *M. gilva* from Columbia is the same species.

5. Mesothemis longipennis, ♂, ♀.

Libellula longipennis Burm.! Handb., II, 850, 12.

Libellula socia Rbr.! Neur., 96, 94.

Libellula truncatula Rbr.? Neur., 95, 92.

Mesothemis longipennis Hag.! Syn., 173, 7; Stett. Z., XXIV, 375, 78; Proc. Bost. Soc. Nat. Hist., XV, 266, 11; XVI, 366, 42; Hayden's Rep., 1872, 728; 1873, 588.— Walsh! Proc. Acad. Philad., 1862, 400.

Hab. Natick, Massachusetts, August; New York; Maryland; Dalton, Savannah, Georgia, May 23; Kentucky, May; Louisiana; Chicago, Rock Island, Illinois; Florida, March; Montana; Yellowstone; Pecos River, Western Texas; Dallas, Waco, Texas, July; Matamoras, Mexico; California; Victoria, Vancouver's Island.

Dr. Brauer forms for this species a new genus, Pachydiplax.

Leucorhinia.

1. Leucorhinia intacta, ♂, ♀.

Diplax intacta Hag.! Syn., 179, 10.— Walsh! Proc. Acad. Philad., 1862, 400.

Hab. Massachusetts; Ohio; Rock Island, Chicago, Illinois; Wisconsin; Ontario, Canada.

2. Leucorhinia hudsonica, ♂, ♀.

Libellula hudsonica Selys! Revue des Odonates, 53.

Diplax hudsonica Hag.! Syn., 180, 11.

Hab. New Brunswick; Winnipeg Lake; Ft. Resolution, Great Slave Lake, Hudson's Bay Territory; Saskatchewan.

Diplax dubia Hag., Syn., 180, 12, from Europe was only described for comparison, and by error of the printer numbered.

3. Leucorhinia borealis, ♂, ♀. (No description.)

Hab. Saskatchewan; Ft. Resolution, Hudson's Bay Territory.

4. Leucorhinia glacialis, ♂. (No description.)

Hab. Michipicoten, Lake Superior; Massachusetts; White Mts., N. H.

5. Leucorhinia proxima, ♂. (No description.)

Hab. British America; Victoria, Vancouver's Island; Massachusetts; White Mts., N. H.

6. Leucorhinia frigida, ♂. (No description.)

Hab. Northern Red River; Massachusetts; Ontario, Canada.

Diplax.

1. Diplax assimilata, ♂, ♀.

Libellula assimilata Uhler? Proc. Acad. Philad., 1857, 88, 6.

Diplax assimilata Hag! Syn. 174, 1; Stett. Z., xxviii, 93.—Walsh, Proc. Acad. Philad., 1862, 400.

Hab. Chicago, Rock Island, Illinois; Washington; St. Louis.

The localities Wisconsin, Pennsylvania, Maryland, are added by Mr. Uhler; I have not seen specimens. I have not examined Mr. Uhler's types from Fort Union, Nebraska; perhaps they belong to the following species. Therefore I retain the name *D. assimilata* for the species described in my Synopsis.

2. Diplax interna, ♂, ♀. (No description.)

Hab. Saskatchewan, Southern Lake Winnipeg, British America; Wisconsin; Minnesota; N. Dakota; White Mts., N. H.

Perhaps this species is *D. assimilata* from Nebraska.

3. Diplax rubicundula, ♂, ♀.

Libellula rubicundula Say, Journ. Acad. Philad., viii, 26, 14.

Diplax rubicundula Hag.! Syn., 176, 6; Proc. Bost. Soc. Nat. Hist., xv, 267, 17; 377, 10;—Scudder! Proc. Bost. Soc. Nat. Hist., x, 219.

Hab. Massachusetts, October; Maine; Mt. Washington, N. Hampshire, August, September; New York; New Jersey; Pennsylvania; Maryland; Washington, D.C.; Michipicoten, Lake Superior and British America; Indiana (Say).

A careful examination of a large number of specimens induces me to separate again the species described by me as *D. assimilata* and *D. rubicundula*, united in an elaborate paper by Messrs. Scudder, Uhler and Walsh.

4. Diplax obtrusa, ♂.

Hagen! Syn., 177, nota after *D. rubicundula*; Stett. Z., xxviii, 95.

Hab. Mass.; Chicago, Illinois; Ontario, Canada, perhaps not different from *D decisa.*

5. Diplax vicina, ♂, ♀.

Diplax vicina Hag.! Syn., 175, 4; Proc. Bost. Soc. Nat. Hist., xv, 267, 16. — Walsh! Proc. Acad. Philad., 1862, 400.

Hab. Brunswick, Maine; Massachusetts; New Jersey; Pennsylvania; Washington; Rock Island, Illinois; Ontario, Canada.

6. Diplax albifrons, ♂, ♀.

Libellula albifrons Charp.! Libell. Europ., 14, pl. 11, f. 3 (male).

Libellula ambigua Ramb.! 106, 105; Selys! Revue Odon., 325 (female).

Diplax albifrons Hag.! Syn., 177, 7; Stett. Z., xxiv, 375, 79; Proc. Bost. Soc. Nat. Hist., xv, 267, 18; ibid., xvi, 363, 43.

Hab. Georgia; St. Louis, Mo.; perhaps Massachusetts; Dallas, Waco, Texas.

The locality Europe, given by Charpentier is erroneous, his type is in my collection. In Syn., 176, 6, I erroneously quoted *L. ambigua* as *D. rubicundula.*

7. Diplax pallipes, ♂.

Diplax pallipes Hag.! Hayden Rep., 1873, 589.

Hab. Foot Hills, Colorado; Dallas, Texas; but the specimens from Texas were not carefully examined.

8. Diplax decisa, ♂, ♀.

Diplax decisa Hag.! Hayden Rep., 1873, 588.

Diplax assimilata Hag.! Hayden Rep., 1872, 728.

Hab. Foot Hills, Colorado; Colorado Mountains, Pacific slope; August 15–September 6; Yellowstone; Dakota.

9. Diplax atripes, ♂, ♀.

Diplax atripes Hag.! Hayden Rep., 1873, 588.

Hab. Yellowstone.

10. Diplax semicincta, ♂, ♀.

Libellula semicincta Say! Journ. Acad. Philad., viii, 27, 15.

Diplax semicincta Hag.! Syn., 176, 5; Proc. Bost. Soc. Nat. Hist., xv, 267, 19; Hayden Rep., 1873, 590.

Hab. Maine; Massachusetts; White Mts., N. H.; Pennsylvania; Maryland.

I possess a pair in bad condition, from California, and a female from Yellowstone, quoted in Report, 1873. Perhaps they belong to a different species.

11. Diplax madida, ♂, ♀.

Diplax madida Hag.! Syn., 174, 2.

Hab. Upper Missouri River; Yellowstone; Gulf of Georgia, Cal.; Victoria, Vancouver's Island.

12. Diplax costifera, ♂, ♀.

Diplax costifera Hag.! Syn., 175, 3.

Hab. Maine; Massachusetts; New York; N. Red River.

13. Diplax flavicosta, ♂, ♀. (No description.)

Hab. San Diego, California.

14. Diplax Berenice, ♂, ♀.

Libellula Berenice Drury, Ins., I, 114, pl. 48, f. 3 (female).—Oliv., Enc. Method. — Say! Journ. Acad. Philad., VIII, 25, 13.— Ramb.! Neur., 88, 80.

Libellula histrio Burm.! Handb., II, 849, 7 (female).

Diplax Berenice Hag.! Syn., 178, 8; Proc. Bost. Soc. Nat. Hist., XV, 266, 15.

Hab. Massachusetts; New York; N. Jersey; Maryland; Virginia.

15. Diplax scotica, ♂, ♀.

Libellula scotica Donov., XV, 523.—Selys! Revue des Odonates, 48. 22 (with the synonyms).

Diplax scotica Hag.! Syn., 179, 9; Hayden Rep., 1872, 728.

Hab. N. Red River; Ontario, Canada; perhaps Yellowstone. Common in Europe and N. Asia. Guatemala? (coll. de Selys).

16. Diplax ochracea, ♂, ♀.

Libellula ochracea Burm.! Handb., II, 854, 38.

Libellula fervida Erichs.! Voy. Schomburgk, II, 584.

Libellula justina Selys! Sagra Ins. Cuba, 450.

Diplax ochracea Hag.! Syn., 181, 13.

Hab. Tampico, Mexico; Cuba; Choco, N. Grenada and South America.

17. Diplax ambusta, ♂, ♀.

Libellula minuscula Ramb.! Neuropt., 115, 118 (in part).

Diplax justiniana Hag.! Syn., 181, 14; Proc. Bost. Soc. Nat. Hist., XI, 293; XV, 375, 14.— Scudder! Proc. Bost. Soc. Nat. Hist., X, 197.

Hab. Cuba; Isle of Pines.

I suppose *L. justiniana* Selys, is a different species.

18. Diplax justiniana, ♂, ♀.

Libellula justiniana Selys! Sagra Ins. Cuba, 450.

Hab. Cuba.

19. Diplax fraterna, ♂, ♀.

Diplax fraterna Hag.! Proc. Bost. Soc. Nat. Hist., XV, 375, 13.

Diplax ochracea Scudder! Proc. Bost. Soc. Nat. Hist., X, 196 (female).

Diplax abjecta Scudder! Proc. Bost. Soc. Nat. Hist., x, 197 (male).
Hab. Cuba; Isle of Pines.

20. Diplax credula, ♂, ♀.

Diplax credula Hag.! Syn., 184, 19.
Hab. St. Thomas, Brazil.

21. Diplax abjecta, ♂, ♀.

Libellula abjecta Ramb.! Neuropt., 83, 73.
Diplax abjecta Hag.! Syn., 184, 20.
Hab. Cuba; S. America.

22. Diplax imbuta, ♂, ♀.

Libellula imbuta Say, Journ. Acad. Philad., VIII, 32.
Diplax imbuta Hag., Syn., 185, 21.
Hab. Island of Sanipuxten, Maryland. Unknown to me.

23. Diplax ornata, ♂, ♀.

Libellula ornata Ramb.! Neuropt., 96, 93.
Diplax ornata Hag.! Syn., 182, 16; Proc. Bost. Soc. Nat. Hist., XV, 266, 14; XVI, 363, 46.
Hab. Pennsylvania; Florida; Georgia.

24. Diplax amanda, ♂, ♀.

Libellula pulchella Burm.! Handb., II, 849, 2.
Diplax amanda Hag.! Syn., 183, 17; Stett. Z., XXIV, 375, 81; Proc. Bost. Soc. Nat. Hist., XVI, 363, 45.
Hab. Georgia; New Jersey.

25. Diplax minuscula, ♂, ♀.

Libellula minuscula Rbr.! Neuropt., 115, 118 (in part).
Diplax minuscula Hag.! Syn., 183, 18; Stett. Z., XXIV, 375, 32; Proc. Bost. Soc. Nat. Hist., XV, 268, 20; XVI, 363, 47.
Hab. Kentucky; Georgia; Florida; Brazil.

NANNODIPLAX Brauer.

1. Nannodiplax vacua, ♀.

Diplax vacua Hag.! Stett. Z., XXVIII, 91.
Hab. Saskatchewan, British America.

PERITHEMIS.

1. Perithemis Domitia, ♂, ♀.

Libellula Domitia Drury, Ins., II, 83, pl. 45, f. 4.—Burm.! Handb., II, 855, 40. — Ramb.! Neuropt., 124, 132.
Perithemis Domitia Hag.! Syn., 185, 1; Stett. Z., XXVI, 375, 83;

Proc. Bost. Soc. Nat. Hist., xv, 375, 15; ibid., xvi, 363, 48.—Scudder! Proc. Bost. Soc. Nat. Hist., x, 198.—Walsh! Proc. Acad. Philad., 1862, 400.

Libellula tenuicincta Say, Journ. Acad. Philad., viii, 31, 21 (male).

Libellula tenera Say! Journ., Acad. Philad., viii, 31, 20 (female).—Hag., Proc. Bost. Soc. Nat. Hist., xv, 268, 21.

Libellula chlora Ramb.! Neuropt., 125, 133.

Libellula Metella Selys! Sagra Ins. Cuba, 451.

Libellula Iris Hag.! Syn., 185, var.

Hab. Massachusetts; New York; New Jersey; Pennsylvania; Maryland; Indiana; Illinois; Georgia; Louisiana; Texas; Mexico; Cuba; South America.

Nannothemis Brauer.

1. **Nannothemis bella,** ♂, ♀.

Nannophya bella Uhler! Proc. Acad. Philad., 1857, 87, 1.—Hag.! Syn., 186, 1; Stett. Z., xxiv, 375, 84; xxviii, 90; Proc. Bost. Soc. Nat. Hist., xvi, 363, 49.

Hab. Maine; Massachusetts; Connecticut; N. Jersey; Maryland; Georgia; Ontario, Canada.

2. **Nannothemis maculosa,** Hag.! Syn., 187, 2; Stett. Z., xxiv, 375, 85; xxviii, 90; Proc. Bost. Soc. Nat. Hist., xvi, 363, 50.

Hab. Georgia.

South America.

Subfamily LIBELLULINA.

Pantala.

1. **Pantala flavescens,** ♂, ♀. (cf. N. America.)

Hab. Venezuela; Surinam; Para; Brazil.

Tholymis.

1. **Tholymis citrina,** ♂, ♀. (cf. N. America.)

Hab. Para, Brazil.

Tramea.

1. **Tramea basalis,** ♂, ♀.

Libellula basalis Burm.! Handb., ii, 852, 25.

Libellula flavia Selys! Mss.

Tramea basalis Hag.! Syn., 316.

Hab. Brazil; Surinam.

2. Tramea binotata, ♂, ♀.

Libellula binotata Ramb.! Neur., 36, 7.

Tramea binotata Hag.! Syn., 316.

Hab. Minas Geraes, Brazil.

3. Tramea Cophysa, ♂.

Tramea Cophysa Hag.! Syn., 316; Stett. Z., XXVIII, 226.

Libellula Cophysa Selys! Sagra Ins. Cuba, 441. (No description.)

Hab. Brazil.

4. Tramea Marcella, ♂, ♀. (cf. N. America.)

Hab. Brazil; Turbo, New Grenada.

5. Tramea Iphigenia, ♂, ♀ (?)

Tramea Iphigenia Hag.! Stett. Z., XXVIII, 230; ibid., XXX, 262, 17.

Hab. Bogota, New Grenada. An aberrant species. Perhaps the female from Turbo, New Grenada, does not belong here.

6. Tramea Argo, ♂.

Tramea Argo Hag., Stett. Z., XXX, 268.

Hab. Rio Janeiro.

7. Tramea subbinotata, ♂.

Tramea subbinotata Brauer, Verhdl. Wien. Z. B. G., XVII, 811.

Hab. Brazil.

8. Tramea longicauda, ♂.

Tramea longicauda Brauer, Verhdl. Wien, Z. B. G., XVII, 812.

Hab. Brazil.

9. Tramea braziliana, ♂.

Tramea braziliana Brauer, Verhdl. Wien Z. B. G., XVII, 812.

Hab. Brazil.

The three species are not known to me.

Libellula.

1. Libellula umbrata, ♂, ♀. (cf. N. America.)

Libellula umbrata Hag.! Syn., 316; Stett. Z., XXX, 263, 18; Foerhdl., Dansk. V. S., 1855, 122.

Hab. St. Fé de Bogota, Turbo, New Grenada; Porto Cabello, Venezuela; Surinam; Essequibo; Bahia, Rio, Buenos Ayres, Brazil; Corrientes. Very common.

2. Libellula effrenata, ♀.

Libellula effrenata Hag.! Foerhdl. Dansk. V. S., 1855, 125. (No description.)

Diplax effrenata Hag.! Syn., 319.

Hab. Lagoa Santa, Brazil.

Subgenus ORTHEMIS.

3. Libellula discolor, ♂, ♀. (cf. N. America.)

Libellula discolor Hag.! Syn., 316; Stett. Z., xxx, 263, 19.—Foerhd. Dansk. V. S., 1855, 121, 122.

Hab. St. Fé de Bogota, New Grenada; Porto Cabella, Venezuela; Guiana; Surinam; Chili; Ecuador, Guayaquil; Peru; Bahia, Pernambuco, Minas Geraes, Rio, Brazil.

Very common.

LEPTHEMIS.

1. Lepthemis vesiculosa, ♂, ♀.

Lepthemis vesiculosa Hag.! Syn., 316. (cf. N. America.)

Hab. Guiana; Bahia, Pernambuco, Rio, Brazil.

2. Lepthemis hæmatogastra, ♂, ♀.

Lepthemis hæmatogastra Hag.! Syn., 316. (cf. N. America.)

Hab. St. Fé de Bogota, New Grenada; Surinam; Pernambuco, Brazil.

3. Lepthemis Attala, ♂, ♀.

Lepthemis verbenata Hag.; Syn., 316.—Foerhdl., Dansk. V. S., 1855, 125. (cf. N. America.)

Libellula Isis Selys. (No description.)

Hab. Porto Cabello, Venezuela; Surinam; Brazil.

4. Lepthemis appendiculata, ♂.

Libellula appendiculata Hag.! Syn., 316. (No description.)

Hab. Marida, Venezuela.

5. Lepthemis cultriformis, ♂.

Lepthemis cultriformis Hag.! Syn., 316. (No description.)

Hab. Brazil. Probably not different from *L. appendiculata.*

6. Lepthemis picta, ♂, ♀.

Lepthemis picta Hag.! Syn., 316. (No description.)

Hab. Brazil. The locality perhaps erroneous; probably an African species.

7. Lepthemis cardinalis, ♂, ♀.

Lepthemis cardinalis Hag. ! Syn., 316. (cf. N. America.)

Hab. Guiana, Essequibo; Para, Brazil.

8. Lepthemis attenuata, ♂, ♀.

Lepthemis attenuata Hag.! Syn., 316; Stett. Z., xxx, 263, 21.

Libellula attenuata Erichs! Voy. Schomburgk, iii, 583.

Hab. Guiana; Surinam; Brazil; St. Fé de Bogota, New Grenada. I have seen specimens labelled Cape of Good Hope, probably erroneously.

9. Lepthemis extensa, ♂.

Lepthemis extensa Hag., Syn., 316. (No description.)

Hab. Pernambuco, Brazil.

Dythemis.

1. Dythemis nubecula, ♂, ♀.

Libellula nubecula Ramb.! Neur., 122, 129.

Dythemis nubecula Hag.! Syn., 317.

Hab. New Friburg, Brazil.

2. Dythemis constricta, ♂.

Dythemis constricta Selys! (No description.)

Hab. Brazil.

3. Dythemis inermis.

Dythemis inermis Selys. (No description.)

Hab. Brazil.

4. Dythemis rapax, ♂.

Dythemis rapax Hag. ! Syn., 317.

Hab. Venezuela.

5. Dythemis hemichlora, ♂, ♀.

Libellula hemichlora Burm.! Handb., ii, 849, 4.—Hag.! Foerhdl. Dansk. V. S., 1855, 122.

Dythemis hemichlora Hag. ! Syn., 317.

Hab. Venezuela; Bahia, Brazil.

6. Dythemis typographa, ♂.

Dythemis typographa Hag.! Syn., 317. (No description.)

Hab. Chili.

7. Dythemis Cydippe, ♂.

Dythemis Cydippe Hag.! Syn., 317. (No description.)

Hab. Rio, Brazil.

8. Dythemis Liriope, ♂.

Dythemis Liriope Hag.! Syn., 317. (No description.)

Hab. Brazil.

9. Dythemis catenata, ♂.

Dythemis catenata Hag.! Foerhdl. Dansk. V. S., 1855, 125; Syn., 317. (No description.)

Hab. Minas Geraes, Brazil.

10. Dythemis tessellata, ♀.

Libellula tessellata Burm.! Handb., II, 849, 5.

Dythemis tessellata Hag.! Syn., 317.

Hab. Brazil.

11. Dythemis icterica, ♂, ♀.

Dythemis icterica Hag.! Syn., 317. (No description.)

Hab. Brazil.

12. Dythemis sterilis, ♂, ♀.

Libellula tessellata Ramb.! Neuropt., 89, 82.—Hag.! Foerdl. Dansk. V. S., 1855, 121, 122.

Dythemis sterilis Hag.! Syn., 317.

Hab. Venezuela; Surinam; Pernambuco, Bahia, Rio, Brazil; Buenos Ayres; Lima, Peru; Panama; Quillota.

13. Dythemis columba, ♂.

Dythemis columba Hag.! Syn., 317. (No description.)

Hab. Venezuela.

14. Dythemis infamis, ♂.

Dythemis infamis Hag.! Syn., 317. (No description.)

Hab. Pernambuco, Brazil.

15. Dythemis musiva, ♀.

Dythemis musiva Hag.! Syn., 317. (No description.)

Hab. Rio, Minas Geraes, Brazil.

16. Dythemis apicalis, ♂.

Dythemis apicalis Hag.! Stett. Z., XXVIII, 90. (No description.)

Hab. Surinam.

17. Dythemis gerula, ♂.

Dythemis gerula Hag.! Syn., 317. (No description.)

Hab. New Friburg, Brazil.

18. Dythemis lepida, ♂.

Dythemis lepida Hag.! Syn., 317; Stett. Z., XXX, 263, 21. (No description.)

Hab. New Friburg, Brazil; St. Fé de Bogota, New Grenada.

19. Dythemis tabida, ♂, ♀.

Dythemis tabida Hag.! Syn., 317. (No description.)

Hab. Bahia, Brazil.

Macrothemis.

1. Macrothemis pleurosticta, ♂.

Libellula pleurosticta Burm.! Handb., II, 849, 3.

Dythemis pleurosticta Hag.! Syn., 317.

Macrothemis pleurosticta Hag.! Stett. Z., XXIX, 285, 2.

Hab. Brazil.

2. Macrothemis tenuis, ♂.

Dythemis tenuis Hag.! Syn., 317.

Macrothemis tenuis Hag.! Stett. Z., XXIX, 286, 2.

Hab. New Friburg, Brazil.

3. Macrothemis marmorata, ♂, ♀.

Dythemis marmorata Hag.! Syn., 317.

Macrothemis marmorata Hag.! Stett. Z., XXIX, 286, 3.

Hab. New Friburg, Brazil.

4. Macrothemis columbiana.

Macrothemis columbiana Selys, Stett. Z., XXIX, 285. (No description.)

Hab. Columbia. Unknown to me.

5. Macrothemis Zephyra.

Macrothemis Zephyra Selys, Stett. Z., XXIX, 285. (No description.)

Hab. Brazil. Unknown to me.

Erythemis.

1. Erythemis furcata, ♂, ♀.

Erythemis furcata Hag.! Syn., 317. (cf. N. America.)

Hab. Bahia, Brazil.

2. Erythemis bicolor, ♂, ♀.

Erythemis bicolor Hag.! Syn., 318; Stett. Z., XXX, 263, 23. (cf. N. America.)

Hab. St. Fé de Bogota, Choco, N. Grenada; Surinam; Guiana; Brazil.

3. Erythemis peruviana.

Libellula peruviana Rbr., Neuropt., 81, 69.

Erythemis peruviana Hag.! Syn., 318.

Hab. Peru; perhaps not different from *E. bicolor*.

4. Erythemis lavata.

Erythemis lavata Hag.! Syn., 318. (No description.)

Hab. Venezuela.

5. Erythemis longipes, ♂, ♀.

Libellula tenuipes Hag.! Foerhdl. Dansk. V. S., 1855, 125. (No description.)

Erythemis longipes Hag.! Syn., 318 (in part).

Hab. Rio, Minas Geraes, Brazil.

6. Erythemis ? rubriventris.

Libellula rubriventris Blanch., Voy. d'Orbigny, 217, pl. 28, f. 4.

Erythemis ? rubriventris Hag., Syn., 318.

Hab. Corrientes; unknown to me, probably *E. peruviana.*

MESOTHEMIS.

1. Mesothemis gilva, ♂, ♀.

Mesothemis gilva Hag.! Syn., 318; Stett. Z., xxx, 263, 23. (No description.)

Hab. New Grenada; Venezuela; Columbia; perhaps not different from *M. illota.*

2. Mesothemis annulata.

Libellula annulata Palisot de Beauv., Ins. Neuropt., 58, pl. 3, f. 3. —Ramb.! Neuropt., 78, 65 (in part).

Mesothemis annulata Hag.! Syn., 318.

Hab. Brazil.

3. Mesothemis annulosa.

Mesothemis annulosa Selys! (No description.)

Hab. Rio, Brazil; Paramaribo.

Subgenus ERYTHRODIPLAX.

4. Mesothemis plebeja, ♂, ♀.

Libellula plebeja Ramb.! Neuropt., 107, 106. — Blanchard, Gay Ins. Chili, VI, 111.—Hag.! Foerhdl. Dansk. V. S., 1855, 121.

Mesothemis plebeja Hag.! Syn., 318.

Erythemis corallina Brauer, Voy. Novara, 84.

Hab. Chili; Quillota.

5. Mesothemis connata, ♂, ♀.

Libellula connata Burm.! Handb., II, 855, 14. — Hag.! Foerhdl. Dansk. V. S., 1855, 121.

Mesothemis connata Hag.! Syn., 318.

Hab. Valparaiso; Quillota.

6. Mesothemis ? communis, ♂, ♀.

Libellula communis Rbr.! Neuropt., 93, 88.—Blanchard, Gay, Ins. Chili, VI, 111, pl. 2, f. 4.

Mesothemis ? communis Hag.! Syn., 318.

Hab. Chili.

7. Mesothemis ? chloropleura, ♂, ♀.

Diplax ? chloropleura Brauer, Voy. Novara, 88.

Hab. Chili. Unknown to me.

8. Mesothemis ? leontina, ♂.

Libellula leontina Brauer, Voy. Novara, 93.

Hab. Chili. Unknown to me.

9. Mesothemis distinguenda, ♂, ♀.

Libellula distinguenda Ramb.! Neuropt., 81, 68.

Libellula incompta Ramb.! Neuropt., 119, 124 (fem.).

Mesothemis distinguenda Hag.! Syn., 318.

Hab. Cayenne.

10. Mesothemis ? abbreviata.

Libellula abbreviata Ramb., Neurop., 119, 123.

Mesothemis ? abbreviata Hag.! Syn., 318.

Hab. Cayenne.

11. Mesothemis ? anomala.

Libellula anomala Brauer, Voy. Novara, 90.

Hab. Rio, Brazil. Unknown to me.

Diplax.

1. Diplax ochracea, ♂, ♀.

Diplax ochracea Hag.! Syn., 318. (cf. N. America.)

Hab. Porto Cabello, Venezuela; Guiana; Surinam; Bahia, Brazil.

2. Diplax minuscula, ♂, ♀.

Diplax minuscula Hag.! Syn., 318. (cf. N. America.)

Hab. Brazil.

3. Diplax credula, ♂, ♀.

Diplax credula Hag.! Syn., 318. (cf. N. America.)

Diplax apollina Hag.! Syn., 319, female. (No description.)

Hab. Minas Geraes, Brazil.

4. Diplax abjecta, ♂, ♀.

Diplax abjecta Hag.! Syn., 318; Stett. Z., XXX, 263, 24. (cf. N. America.)

Hab. Venezuela; Brazil; St. Fé de Bogota, New Grenada.

5. Diplax obesa, ♂, ♀.
Diplax obesa Hag.! Syn., 318. (No description.)
6. Diplax unimaculata, ♂, ♀.
Libellula unimaculata De Geer, Mém,, III, 558, 4, pl. 26, f. 5.—Burm., Handb., II, 855, 43.
Diplax unimaculata Hag.! Syn., 318.
Hab. Surinam; Guiana; Pernambuco, Brazil.
7. Diplax famula, ♂, ♀.
Libellula famula Erichs! Voy. Schomburgk, III, 584.
Diplax famula Hag.! Syn., 318.
Hab. Guiana.
8. Diplax fusca, ♂, ♀. (Erythrodiplax Brauer.)
Libellula fusca Rbr.! Neuropt., 78, 64.
Diplax fusca Hag.! Syn., 318.
Diplax Catharina Hag.! Syn., 319. (No description.)
Hab. Cayenne; Bahia, Minas Geraes, New Friburg, Brazil.
9. Diplax indigna, ♂, ♀.
Diplax indigna Hag.! Syn., 319. (No description.)
Hab. New Friburg, Brazil.
10. Diplax Juliana, ♂.
Diplax Juliana Hag.! Foerhdl. Dansk. V. S., 1855, 125; Syn., 319. (No description.)
Hab. Brazil; Lagoa Santa.
11. Diplax postica, ♂.
Diplax postica Hag.! Syn., 319. (No description.)
Hab. New Friburg, Brazil.
12. Diplax Fausta, ♂, ♀.
Diplax Fausta Hag.! Syn., 319. (No description.)
Hab. New Friburg, Brazil.
13. Diplax Faustina, ♂, ♀.
Diplax Faustina Hag.! Syn., 319. (No description.)
Hab. Bahia, New Friburg, Brazil.
14. Diplax contusa, ♂, ♀.
Diplax contusa Hag.! Syn., 319. (No description.)
Hab. New Friburg, Venezuela, Bahia, Brazil.
15. Diplax latimaculata, ♂.
Diplax latimaculata Hag.! Foerhdl. Dansk. V. S., 1855, 125; Syn., 319. (No description.)
Hab. Bahia, Minas Geraes, Brazil.

16. Diplax sobrina.

Libellula sobrina Ramb.! Neuropt., 114, 116.

Diplax sobrina Hag. ! Syn., 319; Foerhdl. Dansk. V. S., 1855, 125.

Hab. Rio, Minas Geraes, Brazil.

17. Diplax exusta, ♂, ♀.

Diplax exusta Hag.! Foerhdl. Dansk. V. S., 1855, 122. (No description.)

Hab. Rio, Brazil.

18. Diplax familiaris, ♂, ♀.

Diplax familiaris Hag.! Foerhdl. Dansk. V. S., 1855, 122; Syn., 319. (No description.)

Hab. Bahia, Brazil.

19. Diplax agricola, ♂, ♀.

Diplax agricola Hag. ! Syn., 319. (No description.)

Hab. Bahia, Brazil.

20. Diplax Luciana, ♂, ♀.

Diplax Luciana Hag. ! Syn., 319. (No description.)

Hab. New Friburg, Brazil.

21. Diplax flavilatera, ♂, ♀.

Diplax flavilatera Hag. ! Syn., 319; Foerhdl. Dansk. V. S., 1855, 122. (No description.)

Hab. Rio, Brazil.

22. Diplax bilineata, ♂, ♀.

Diplax bilineata Hag.! Syn., 319. (No description.)

Hab. New Friburg, Brazil.

23. Diplax castanea, ♂, ♀.

Libellula castanea Burm. ! Handb., II, 854, 39.

Hab. Bahia, Brazil.

24. Diplax venosa, ♀.

Libellula venosa Burm.! Handb., II, 848, 1.

Diplax venosa Hag. ! Syn., 319.

Hab. Bahia, Brazil.

25. Diplax oscularis, ♂.

Diplax oscularis Hag. ! Syn., 219. (No description.)

Hab. Brazil.

26. Diplax cyanifrons, ♂.

Diplax cyanifrons Hag. ! Syn., 319. (No description.)

Hab. Brazil.

27. Diplax pulla, ♀.

Libellula pulla Burm. ! Handb., II, 855, 41.

Diplax pulla Hag.! Syn., 319.
Hab. Surinam; probably *D. minuscula.*

28. Diplax nigricans.

Libellula nigricans Ramb.! Neurop., 97, 95.
Diplax nigricans Hag., Syn., 319.
Hab. Buenos Ayres.

29. Diplax vilis.

Libellula vilis Ramb.! Neuropt., 98, 96.
Diplax vilis Hag., Syn., 319.
Hab. Buenos Ayres.

30. Diplax inversa, ♀.

Libellula inversa Hag., Foerhdl. Dansk. V. S., 1855, 122.
Hab. Rio, Brazil.

Perithemis.

1. Perithemis Domitia, ♂, ♀.

Perithemis Domitia Hag.! Syn., 319. (cf. N. America.)
Hab. Venezuela; Minas Geraes, Bahia, St. Leopoldo, Brazil Cordova, Argentine Republic.

2. Perithemis Lais, ♂, ♀.

Libellula Lais Perty ! Delect., 125, pl. 25.
Perithemis Lais Hag. ! Syn., 319.
Hab. Pernambuco, Bracil.

3. Perithemis Thais, ♀.

Perithemis Thais Hag. ! Syn., 320. (No description.)
Hab. Japazos, Amazon.

4. Perithemis Cloe.

Perithemis Cloe Hag.! Syn., 320. (No description.)
Hab. Brazil.

5. Perithemis bella, ♂.

Perithemis bella Hag. ! Syn., 320. (No description.)
Hab. Para, Brazil.

Nannothemis Brauer.

1. Nannothemis semiaurea.

Nannophya semiaurea Hag., Syn., 320; Stett. Z., xxviii, 90. (No description.)
Hab. Para, Brazil.

2. Nannothemis prodita, ♂, ♀.

Nannophya prodita Hag.! Syn., 320; Stett. Z., XXVIII, 90. (No description.)

Nannophya inermis Selys! (no description). — Hag., Stett. Z., XXVIII, 90.

Hab. Pernambuco, Brazil.

3. Nannothemis Phryne, ♂.

Libellula Phryne Perty! Delect., 125, pl. 25, f, 3.

Dythemis Phryne Hag.! Syn., 317; Stett. Z., XXVIII, 90.

Dythemis apicalis Hag.! Syn., 317.

Hab. Rio, Piauhy, Brazil; Surinam.

4. Nannothemis sp.

Nannothemis sp. Hag., Stett. Z., XXVIII, 90. (No description.)

Hab. Peru.

Uracis.

1. Uracis imbuta, ♂, ♀.

Libellula imbuta Burm.! Handb., II, 850, 9.

Uracis quadra Ramb.! Neuropt., 31, pl. 2, f. 5.

Uracis imbuta Hag.! Syn., 320.

Hab. Surinam; Bahia, Paramaribo, Minas Geraes, Brazil; Guiana; Columbia; Panama.

2. Uracis fastigiata, ♂.

Libellula fastigiata Burm.! Handb., II, 850, 10.

Uracis fastigiata Hag.! Syn., 320.

Hab. Bahia, Brazil.

3. Uracis irrorata, ♂, ♀.

Uracis irrorata Hag.! Syn., 320. (No description.)

Hab. Bahia, Brazil.

4. Uracis ovata, ♂, ♀.

Uracis ovata Hag.! Syn., 320. (No description.)

Hab. Bahia, Brazil.

Urothemis.

1. Urothemis guttata, ♂, ♀.

Uracis guttata Hag.! Syn., 320.

Libellula guttata Erichs! Schomburgk Voy., III, 584.

Hab. Guiana; Brazil.

2. Urothemis infumata, ♂.

Libellula infumata Ramb.! Neuropt., 74, 59.

Uracis infumata Hag.! Syn., 320.

Hab. Bahia, Brazil.

3. Urothemis Amphithea, ♂.

Uracis Amphithea Hag.! Syn., 320. (No description.)

Hab. Para, Brazil.

4. Urothemis Clymene, ♂.

Uracis Clymene Hag.! Syn., 320. (No description.)

Hab. Pernambuco, Brazil.

Palpopleura.

1. Palpopleura fasciata, ♂.

Libellula fasciata Linné, Syst. Nat., II, 903, 12. — Fabr., Ent. Syst., II, 378, 20 (in part).—Burm., Handb., II, 854, 37.

Palpopleura fasciata Ramb.! Neuropt., 134, 8 (in part). — Hag. Syn., 320.

Hab. Surinam, Brazil.

2. Palpopleura americana, ♂, ♀.

Libellula americana Linné, Syst. Nat., II, 904, 16.— Fabr., Ent. Syst., II, 378 (in part).— DeGeer, Mém., III, 559, 7, pl. 24, f. 7.— Seba, Thes., pl. 78, f. 11, 12.

Palpopleura fasciata Ramb.! Neuropt., 134, 8 (in part).

Palpopleura americana Hag.! Syn., 320.

Hab. Brazil.

3. Palpopleura circumcincta.

Palpopleura circumcincta Hag., Syn., 329.

Hab. Brazil.

Diastatops.

1. Diastatops dimidiata, ♂, ♀.

Libellula dimidiata Linné! Syst. Nat., II, 908, 14.— DeGeer, Mém III, 558, pl. 26, f. 6.—Burm.! Handb., II, 854, 36.

Diastatops dimidiata Ramb.! Neur., 129, 1.—Erichs! Voy. Schomburgk, III, 584.— Hag., Syn., 321.

Diastatops fenestrata Hag.! Foerhdl., Dansk. V. S., 1855, 125.

Hab. Surinam; Essequibo, Guiana.

2. Diastatops tincta, ♂.

Diastatops tincta Ramb.! Neuropt., 435, 1.— Erichs! Voy. Schomburgk, III, 584. Hag.! Syn., 321; Foerhdl. Dansk. V. S., 1355, 125.

Hab. Guiana; St. Louis de Maranhon, Minas Geraes, Brazil.

3. **Diastatops pullata**, ♂.

Libellula pullata Burm.! Handb., II, 854, 34.

Diastatops pullata Ramb.! Neuropt., 136, 2, pl. 3, f. 4.—Hag.! Syn., 321.

Hab. Pernambuco, Brazil; Moxos, Peru.

4. **Diastatops obscura**, ♂, ♀.

Libellula obscura Fabr., Ent. Syst., II, 377, 15.—Burm.! Handb., II, 584, 35.

Diastatops fuliginea Ramb.! Neuropt., 137, 3.

Diastatops obscura Hag.! Syn., 321.

Hab. Bahia, Brazil.

Prof. W. H. Niles remarked on the comparative whiteness of the snow at different seasons of the year. He thought that the snow was observably whiter in the spring than in the earlier parts of the winter, and attributed the difference to the character of the snow-crystals as those seasons.

Prof. R. H. Richards described some peculiar forms of ice-crystals, formed at a very low temperature in a barrel containing salt water.

May 19, 1875.

The President in the chair. Thirty-eight persons present.

After the usual preliminary business, the President, introducing Prof. Rogers, said:—

I know that you all have observed with great pleasure the presence with us this afternoon, after long absence from illness, of our distinguished, highly valued, and I may add much beloved, brother member Wm. B. Rogers; and as it seems to me meet on this occasion that the feelings that move every heart should be openly expressed, I venture in your behalf to tender him your congratulations upon that restoration to health which permits him once again to take part in our proceedings; and to express the hope that he may often in future, as he was wont to do in former years, grace our meetings by his presence and instruct us by his wise and eloquent contributions.

Geological Notes. By Prof. William B. Rogers.

Art. I. On the Newport Conglomerate.

It will be remembered that in a communication to the American Association in 1860, and in fuller detail in a paper on "The Metamorphism of Conglomerates," published in Silliman's Journal the following year, the late distinguished Geologist, Prof. Edward Hitchcock, endeavored to show that the generally elongated form and closely fitting arrangement of the pebbles in the Newport conglomerate were due to the influence of heat or other agencies softening the rock, combined with a continued pressure and tension, by which the pebbles were squeezed and drawn out in their semi-plastic condition.

To this view I objected, on the ground that such an action applied on a large scale must have had the effect not only of flattening the pebbles in a uniform direction, but of developing a cleavage or lamination of them, all parallel to their flat sections as they lie in the mass. For this and other reasons set forth in the Proceedings of the Society, in a paper communicated the same year, I maintained that the forms and arrangement of the pebbles were those which had resulted from the wearing action of the tides and currents, by which they had been originally moulded in the process of their deposition and accumulation; not doubting, however, that in some metamorphic districts conglomerate rocks are to be found, which have sustained great internal changes through the effects of heat, chemical action and violent pressure.

At a subsequent meeting of the American Association (1869), the plastic theory was again brought forward, and an argument in its favor was drawn from the then recent experiments of Prof. Tresca of the Conservatoire des Arts et Métieres, on what he calls the "flow of solids," and this argument seems hitherto to have passed unchallenged. When, however, we refer to the results of these experiments, we find the fact that in all cases the solid subjected to the moulding force exhibited a striking alteration of its structure; a bar of metal, for example, thus forced through a contracted opening, being reduced in diameter, and presenting after its changes a series of concentric, loop-like curves, marking surfaces of lamination or partial separation, caused by the relative motions of the different parts. It would seem, therefore, that any flattening and elongation of the pebbles in the conglomerate could not fail to be followed by some analogous alteration of structure, and as the pressures or tensions must be conceived to have pervaded the rocks generally, it was to be expected that such induced lamination, or other structure, would be found common to all the pebbles making up the mass. But on careful examination of the principal exposures of the Newport conglomerate, I have met with no evidence of such superinduced structure, although from the fact that the pebbles are for the most part rolled fragments of quartz, quartzite, sandstones and silicious slates, having a more or less jointed or laminated character, an opportunity is frequently presented on the smooth face of the rock for studying their internal structure.

As an illustration of how independent the lamination and joints of the several fragments are of such hypothetical moulding forces, I have made a tracing of the conglomerate surface, at a particular locality of the Purgatory Rocks, on transparent cloth, which enables me to lay down the actual outlines of the several pebbles with the direction of the laminæ in each. In this diagram it may be seen that the lamination has very various directions, and that it extends entirely across the pebbles, leaving no room for supposing even a superficial moulding effect from pressure. The predominant direction of the laminæ, as might be expected, conforms to the general direction of the oblong pebbles, but even in cases where the conformity is most striking, and the appearance of flattening by pressure most marked, pebbles are interspersed in which the lamination has various transverse directions, sometimes even at right angles to the strike.

It would seem, therefore, in view of these facts, that there is nothing in the structure of the Newport conglomerate to sustain the hypothesis referred to, or to call for further mechanical agency than the transporting and wearing actions under which it is believed such materials have been generally moulded and accumulated, together with the tangential or other pressures, which have been concerned in determining their stratigraphical position. Of the operation of these latter forces there can of course be no question, as the rocky masses of the conglomerate have been forced into steep and alternating dips. Moreover, the cracked and fissured condition, so frequent in the larger masses of quartz and quartzite, suggests the action of a crushing force. Nor can it be doubted that chemical changes have been wrought in the material in which the pebbles are embedded, and even occasionally in the surfaces of the pebbles themselves, giving rise to the crystalline grains of magnetite scattered through the former, to the mica-like scales which are found adhering to the pebbles, as well as the cavities left by their removal, and to the slight pitting or striation with which the pebbles are sometimes marked.

In regard to the generally elongated form of the pebbles in these rocks, my observation of the breakers at various points on our coast has led me to the conclusion that there is a marked difference in the action of the impinging waves, due to differences in the slope and smoothness, and the greater or less irregularity and contraction laterally of the shores, so that while in some cases the movement is chiefly a vertical whirling in the direction of the advancing wave, in others it includes also various gyrations transverse to this. In the former of these conditions the movement imparted to the pebbles at the shore would, it might be expected, grind them by mutual attrition, and the wearing action of the sand, into oblong forms, while in the latter conditions it would tend to bring them into lenticular, or into more or less spherical shapes. The former of these modes of action seems to prevail at many localities along the Newport shores, and the latter is well exemplified by the lenticular forms so abundant in the pebbles brought from the coast of Newfoundland.

The flattened shape of many of the large masses may, to some extent, be ascribed to the attrition operating upon them while partly embedded and at rest, but chiefly to the laminated structure of many of the fragments, causing them to break by concussion into flat masses and to yield to erosive forces more rapidly in the planes of the laminæ than in transverse directions.

There is often a difficulty in determining the dip of these conglomerate beds, from the fact that in some of them the pebbles, instead of lying with their longer sections parallel to the planes of bedding, are placed partly edgewise to these planes, but by tracing the separating beds or layers of sandstone it is usually possible to discern the inclination of the strata. This oblique arrangement of the pebbles resembles what is to be seen in similar accumulations of large pebbles along the upper part of steep sea beaches of the present day, or it may possibly have been caused, as has been asserted in some cases, by an actual turning of the pebbles from their originally flat position by the oblique action of the upheaving force.

A striking feature in the general structure of these rocks, is the system of vertical joints by which they are traversed, and which have often been alluded to by former observers. These joints, ranging nearly east and west, or at right angles to the strike of the beds, are usually at distances of twelve to fifteen feet apart, but in some cases they divide this interval by parallel clefts only a few inches asunder. Where this is the case the wearing action of the waves finds comparatively little opposition, and the cliff in process of time is cut back, so as to form a chasm of greater or less length, whose vertical parallel sides extend from the top of the cliff to its base. Of these effects of erosion, one of the most striking is the well-known chasm at Purgatory, near Newport, which has been erroneously regarded as due to the decay of a dyke of trap, supposed to have occupied the cavity.

As already stated, the above objections to the plastic theory are meant to apply simply to the mass known as the Newport conglomerate, having its typical locality in the Purgatory rocks, and are not intended to throw doubt on the evidences of metamorphic action, mechanical and chemical, with which, in other cases, geologists are familiar. Of the reality of former movements within the substance of rocky strata we have abundant illustration in the actions by which slaty cleavage has been induced, and by which, in connection with this structure, the lengthening, shortening, and other distortions of the enclosed fossils have been brought about. These distortions, however, in most cases, are to be explained not so much by a direct compressing or extending force, as by the effect of the sliding of the laminæ upon each other in definite directions, carrying with them the corresponding linear elements of the fossil, or its impression; so that without any necessary condensation or stretching of the mass, the distorted forms may be regarded as so many geometrical projections of the fossil on differently inclined planes.

In recent explorations of the conglomerate, I have obtained impressions which, although indistinct, are suggestive of the "Lingula," found many years ago in the conglomerate rock in the neighborhood of Fall River, a deposit probably on the same, or nearly the same, geological horizon with the Newport conglomerate. Besides these specimens, which were broken from the rock in place, I have found numerous large pebbles on the adjoining beach crowded with well-preserved impressions of the same fossil. These pebbles, both in place and scattered, consist of a gray silicious rock or quartzite, seemingly referable to some member of the primordial group, of which a remnant is exposed in southeastern Massachusetts, and perhaps a larger extent is concealed by drift, and which probably at one period spread northeastward over extensive areas now covered by the sea.

Art. II. On the Gravel and Cobble-stone Deposits of Virginia and the Middle States.

The surface deposits here referred to are extensively exposed in many parts of the belt which marks the junction of the older rocks with the tertiary and upper secondary formations in the Middle States. These deposits, especially in the great river valleys and adjoining slopes, as at Richmond and Washington, consist chiefly of layers of quartz gravel, like the surface gravel of the adjoining primary region, and of larger smoothly rolled masses derived from the silicious slates, quartzites and sandstones of remoter tracts lying to the west and northwest, mingled and interstratified with ferruginous sands and clays, which impart to the mass a more or less reddish color.

In most localities, the larger pebbles are found in the upper part of the deposit, often strewing the surface thickly where the finer matter has been removed either by natural erosion or in the progress of improvement, as may be seen at numerous exposures in and around Washington. In other cases, as at Alexandria and at Richmond, the cobble stone deposit is usually overlaid by stratified sand and gravel of considerable thickness. It is from these sources that the cities of Richmond, Washington, Baltimore and Philadelphia, have been supplied with the paving materials at one time so generally in use.

In a pile of such paving stones in Richmond, Virginia, many years ago, I found a large pebble of compact vitreous sandstone, containing distinct impressions of *Scolithus linearis*, the well-known characteristic fossil of the Primal or Potsdam formation, having its nearest outcrop on the western side of the Blue Ridge. In subsequent observations, especially those recently made in and around Richmond, Washington and Georgetown, I have found that a considerable proportion of this pebbly or cobblestone deposit consists of fragments of the harder silicious Paleozoic rocks, and has therefore been derived from the Appalachian belt. Indeed, so common are the fossiliferous fragments, that an observer can hardly fail to discover them at any of the excavations where the coarser materials are exposed, as well as in the piles of cobblestones in the neighborhood.

In the specimens exhibited to illustrate this paper, collected chiefly at Washington and Richmond, it will be seen that the casts of Scolithus are very distinct and abundant. These masses are from two to six inches in diameter, but in some of the localities much larger specimens may be seen crowded with the fossil. Along with them are occasionally found rounded masses or cobbles of fossiliferous sandstone and of conglomerate, referable to higher positions in the Appalachian series, ranging probably to the carboniferous rocks. The absence from these deposits of fragments derived from the limestones, shales and argillaceous slates of the Appalachian belt, is readily accounted for by the comparative ease with which such materials would be disintegrated by the mechanical and chemical actions concerned in their transportation and deposition, and the same explanation accounts for the fact that so few fragments of the granites, schists and gneissoid and hornblendic rocks of the wide intervening belt have been preserved in this formation, and that it retains little distinctly representing these rocks, except an abundance of quartz gravel and cobbles, derived from them.

The deposit in question extends at Washington over the entire plain on which the city is built, having an average of seventy-five feet, and rising on the north to about one hundred feet above mean tide. Thence it spreads over the adjoining slopes, covering the high ground on which Columbian College is situated, and the still higher hill of the Soldier's Home, which is more than two hundred feet above tide. At the latter locality the rolled fragments have a less average size than at the lower level, though still often several inches in diameter. In the neighborhood of the Capitol, and in the railroad cutting near the Navy Yard, they are often as much as a foot in diameter, and a recent excavation near Georgetown, some forty feet above the creek, has brought to light masses of these transported rounded rocks of still greater dimensions, some of them large enough to be called boulders.

Although the surface formation in question shows itself in, and adjoining, the valleys of all the principal streams in the Middle States, the fragments of paleozoic rocks have thus far been observed only in the deposit as exposed in those river valleys which penetrate westward and northwestward as far as, or into, the Appalachian belt. It is reserved for further observation to ascertain whether they are wholly absent from the shorter valleys, and also to determine to what extent the general deposit is continued from valley to valley over the intermediate higher grounds.

Although from the facts thus far observed, it would seem that the transporting agency by which these deposits were accumulated was chiefly or wholly operative in the lines of the river valleys, the great height to which, as before stated, the deposit reaches, shows that the relative level of the water, or probably ice, concerned in the transportation, must have been much above the water level as it now exists, and that the then actual river valleys were of correspondingly greater width. The distances over which the fragments of Appalachian rocks found in these surface deposits have been carried, may be judged from the following facts.

The distance from Richmond, in a straight line to the nearest outcrop of the Primal or Potsdam sandstone west of the Blue Ridge, is about eighty miles; that following the course of the James River is one hundred and sixty miles; the distance from Washington to the western side of the Blue Ridge in a straight line is about forty miles; that along the Potomac River between fifty and sixty miles.

What relation this deposit bears to the drift of the more northern regions as to the manner and time of its production, is a question of great interest. The materials of the deposit are distinctly stratified, and the fragments, instead of being angular, as so common in the drift proper, are well rounded and smooth. Nor has there been thus far observed, any case of that striation of surface which is so frequently met with in the larger fragments of the northern drift. Tracing the formation, however, as it shows itself successively at Richmond, Washington, and other localities still further northward, the stratification becomes less perfect, and the coarser materials are more scattered through the mass, and after crossing the Delaware the whole deposit cannot be distinguished from the material considered in that region as a modified drift.

Speculating on the causes by which these deposits have been formed, it may, on the one hand, be imagined that during the glacial period the icy covering of the north and west prolonged itself in the valleys of the great rivers, as far south as the James, and even the Roanoke River, bringing down to the belt of land now marking the limit of tide water, debris from the Appalachian rocks, mingled with materials derived from the intervening region, and that the grinding and sorting action of the waters subsequently obliterated glacial marking, and gave to the whole deposit the distribution and stratification which it now presents; or, on the other hand, it may be conceived that the transporting force of the rivers themselves, swollen and rapid as they must have been in the closing ages of the glacial period, brought about the same results. But even, in this case, it is highly probable that glacial action had much to do with the original accumulation of the rocky debris cn the flanks of the Blue Ridge, and in the Appalachian valleys beyond.

In the belt partially occupied by the surface deposit here referred to, there is exposed another group of strata, with which, at first view, the sandy and argillaceous layers of this formation might readily be confounded. These are the silicious, argillaceous and pebbly beds, which, underlying the tertiary in Virginia, and the well marked cretaceous formation further north, have, in the latter region, been regarded as belonging to the base of the cretaceous series of the Atlantic States. In Virginia the formation consists typically of a rather coarse, and sometimes pebbly sandstone, in which the grains of quartz and felspar are feebly cemented by kaolin, derived from the decomposition of the latter, and of argillaceous and silicious clays variously colored, and more or less charged with vegetable remains, either silicified, or in the condition of lignite. These constitute the group of beds designated in the Virginia geological reports as the Upper Secondary Sandstone, and referred by me long since (1842) to the upper part of the Jurassic series, corresponding probably to the Purbeck beds of British geologists. From the Potomac northward, this group of deposits, as exposed in the deep railroad cust between Washington and Baltimore, and on to Wilmington, is made up of variegated, soft, argillaceous and silicious beds, which, from the preponderance of ferruginous coloring towards the Delaware, has been called by Prof. Booth the red clay formation. At a few points only towards the bottom of the deposit, it brings to view a bed of the felspathic sand, or crumbling sandstone, above referred to. Traced transversely, it is seen to dip beneath the cretaceous greensand at various points in New Jersey, Delaware and Maryland, but in Virginia disappears in its eastward dip beneath the Eocene tertiary.

How far we may consider this group of sediments in Maryland, Delaware and New Jersey, as merely a continuation of the Virginia formation above described, can be determined only by further investigation. But the discovery in them at Baltimore, by Prof. Tyson, of stumps of cycads, would seem to bring them into near relation with the formation at Fredericksburg containing similar remains, and to favor their being referred, at least in part, to the horizon of the upper Jurassic rocks. Possibly we may find here a passage-group analogous to the Wealden of British geology. Whatever may be the result of farther discovery, it would seem to be premature at this time to assume the whole of these deposits from the Potomac northward, as belonging to the cretaceous series.

Where the tertiary or the cretaceous rocks are present in this belt, there is, of course, no danger of confounding the superficial gravel and cobblestone deposit with the formation just described, but in their absence, which is usual in the river valleys, this deposit rests immediately on the broken and denuded surface of the secondary, and by the intermixture of materials makes it more difficult to discriminate between them.

Excellent opportunities for observing the contact of the superficial deposit with the denuded and much older formation below, are presented in the neighborhood of Washington, among which may be specially mentioned the vertical cut at the extremity of 16th Street, at the base of the hill occupied by Columbian College, and also the continuation of 14th Street, ascending the same hill. At the former locality the crumbling felspathic sandstone, or slightly adhering sand, is exposed to a height of about thirty-five feet, with a very gentle eastern dip, and having the color, composition and diagonal bedding characteristic of the Fredericksburg and Aquia Creek sandstone. The gravel and cobblestone deposit lying upon it descends with the slope of the hill to the general plain below, resting at a somewhat steep angle against the denuded edges of the underlying beds.[1] From this and other localities, it becomes obvious that the latter formation has been deeply and extensively denuded before and during the deposition of the surface strata, which form the chief subject of this communication.

At Richmond this gravel and cobblestone deposit presents itself at various heights from the river bank to the tops of the hills, mantling the irregularly denuded surface of the underlying formations; resting at one place on the Upper Miocene, at others, on the infusorial stratum, which lies at the base of the Miocene, or on the Eocene, or on the yet older deposit, referable probably to an upper secondary

[1] Since this was written (April, 1875), the excavation and grading have greatly changed the exposure by covering up much of the lower deposit.

period. The well smoothed pebbles are chiefly of quartzite and silicious slates, including not a few which are marked with Scolithus. In the Rappahannock valley, and between it and the Potomac, the formation may be seen resting directly either on the massive secondary sandstone, or on the looser deposit situated next above, or on the Eocene tertiary, which at some points occupies hollows in the denuded surface of the sandstone.

The President announced the gift of a large quartz crystal from Japan, of the kind used in the formation of the well-known Japanese crystal balls, from Capt. Rufus Crowell, to whom the thanks of the Society were voted.

June 2, 1875.

The President in chair. Twenty-five persons present.

Dr. W. G. Farlow gave an interesting account, illustrated by diagram and black-board sketches, of the most recent investigations on the fertilization of Fungi.

The following papers were then read:—

The Decayed Gneiss of Hoosac Mountain.
By T. Sterry Hunt.

In a communication to this Society, published in its Proceedings for Oct. 15, 1873, I noticed the chemical decomposition and decay of the feldspathic and hornblendic rocks of the great Atlantic belt. This, in the Southern States, is seen to have penetrated to a depth of one hundred feet or more, but as we proceed northward becomes less and less evident; until in the hills of New England we find the same rocks, hard, and with glaciated surfaces. It was argued that this decay was a process which had been in operation from remote antiquity, and that the products resulting from it had been the source of the various argillaceous deposits from the earliest paleozoic to the post-pliocene clays, since the removal and deposition of which latter, the process of decay seems to have been insignificant in amount.

Very recently Prof. Pumpelly has called attention to the evidence that the similar decomposition of the stratified orthoclase-porphyries of Eozoic age, with which are associated the iron ores of southeastern Missouri, had already begun in early paleozoic time.

It is known that in various parts in the northeast of the Atlantic belt portions of decayed crystalline rocks are still found *in situ*, having, from the accidents of position, been preserved from denudation. I have to call the attention of the Society to a remarkable example of this, which is seen at the Hoosac Tunnel, at North Adams, in this State, where a good opportunity was afforded for studying the depth of the decay. I have already given some account of it in my report to the Corporators of the Hoosac Tunnel, in October, 1874, which will be found published by the State, in House Document, No. 9, January, 1875.

The locality is at the western base of the Hoosac Mountain, the crest of which here rises rapidly to a height of thirteen hundred feet above the town of North Adams, which is itself seven hundred feet above the sea. The mountain, a part of the north and south Hoosac range, is traversed from east to west by a tunnel 25,081 feet in length, the examination of which shows the rock to be chiefly micaceous gneiss and mica-schist, including in its western half much hard felspathic and quartzose rock, in part a granitoid gneiss. The strata have a prevailing eastern dip, generally at high angles, but with local western dips, apparently due to inversion. Similar rocks are, in many places, exposed on the sides and the crest of the hill, presenting no appearance of decay, but hard, and often with smoothed and striated surfaces. Near its western base, however, the rocks are decomposed to considerable depths, as was well shown in the tunnel. This, for a distance of many hundred feet, was driven in gneissic strata, which, while they preserved their highly inclined attitude, were so much decayed that they were excavated like earth, by means of pick and spade. The brick arch, which has been constructed for a distance of twenty-two hundred feet within the west end of the tunnel and the stone-work of the portal, conceals, for the most part, these decayed strata, but it was easy to procure specimens of them just outside, where excavations were then being made in the bank, exposing sections of several feet of these highly inclined beds. The feldspar had been converted into an unctuous clay, which was well shown in the case of coarsely granitoid layers here interstratified with the more micaceous gneiss. The mica was also very much softened and disintegrated, while the quartz was of course unchanged. I have not yet been able to submit these materials to a chemical examination.

By the courtesy of the State Engineer, Mr. B. D. Frost, I was enabled to get some data with regard to the extent of the decayed, or as it was called by those in charge, the "demoralized" rock. The softening and disintegration of the gneiss were found to be complete for a distance of six hundred feet from the west portal, where the floor of the tunnel is two hundred feet from the surface of the hill, and were partial at one thousand feet from the entrance, where it is two hundred and eighty feet below.

Prof. James Hall, who examined this tunnel immediately after me, and has detailed his observations in the Document already cited, learned that at a distance of twelve hundred feet or more from the western entrance, a bed of brown hematite was traversed in the tunnel, and he afterwards discovered the outcrop of this ore-bed on the hillside above, where it is from four to six feet in thickness. This would indicate that a partial decomposition of the strata extends still deeper than mentioned above, inasmuch as this bed is probably, like the similar ones mined farther southward, in Kent and Salisbury, Connecticut (where they occur in decomposed gneiss rock), the result of an epigenic change of pyrites beds, as was long since pointed out by Prof. C. U. Shepard. The evidence before us seems to justify the conclusion that the whole of the feldspathic rocks of Hoosac Mountain were at one time to a considerable depth from the surface in a decayed and softened condition. The agencies which removed this decomposed rock from the other parts of the mountain, however, spared this portion at its western base, where it still remains, an evidence of a process which has not since affected the exposed and still undecayed portions of the similar rocks which form the surface of the whole Mountain.

Prof. J. D. Dana on the Alteration of Rocks.
By T. Sterry Hunt, LL.D., F.R.S.

A note from Prof. Dana was read at the meeting of this Society in November last, commenting on my remarks on the history of pseudomorphism, and its connection with the alteration of rocks. He has, moreover, seen fit to reproduce his statements with some little variations, on two other occasions within the past year, in the American Journal of Science, the last time in the month of February, in a notice of my lately published volume of "Chemical and Geological Essays," in which I have reprinted, with some additions (pages 317–322) from the same Journal for July, 1872, my reply to his earlier attack upon me, called out by my Presidential address before the American Association for the Advancement of Science in August, 1871 (ibid., pages 283–312). Under these circumstances I deem it due alike to myself and to the cause of truth, to make a brief reply to his repeated assaults. As I have, in the pages just cited, discussed at some length the views of Naumann and of Delesse, to whom Dana refers, I now simply call attention to the fact that I have there shown that the views of the latter in the course of his studies in metamorphism and pseudomorphism underwent a complete change, as shown by his successive publications in 1858, 1859 and 1861. He at first taught the epigenic derivation of serpentine, steatite and chlorite from granite and trappean rocks, a notion which he abandoned in 1861 for that previously taught by myself, according to which these magnesian rocks have originated from the diagenesis of sedimentary hydrous magnesian silicates of aqueous formation.

For many years past my studies have been directed to the origin of mineral species, a question hardly less important for geology than is the origin of species of plants and animals for botany and zoology, and the views which I have arrived at, though treated as worthless by Prof. Dana, seem to have met with approval and acceptance from Delesse, Credner, Gümbel and Favre (ibid., pages 297, 317, 304, 305, 347, 348).

In discussing in 1871, in the above mentioned address, the questions which arise in this connection, I took occasion to notice the very generally received hypothesis of derivation by epigenesis or pseudomorphism, which, as interpreted by its various expounders, admits of many remarkable transformations of one mineral species into another, and to point out some objections to this view. In this discussion I mentioned Prof. Dana's name in connection with some seven or eight others, as having taught the doctrine of pseudomorphism by alteration, and then proceeded to give numerous examples of the supposed change of one crystalline rock into another, as maintained by various authors of this school. I, moreover, stated that Prof. Dana had, in 1858, resumed his own teachings on this subject by declaring that "metamorphism is pseudomorphism on a grand (broad) scale."

To these statements Prof. Dana replied in 1872, that a part of the supposed rock-transformations mentioned by me had never been conceived by him, and that he did not doubt the other writers of the school would repudiate them as strongly as he did. He, moreover, reproached me with having falsely attributed to him the doctrine that "metamorphism is pseudomorphism on a grand scale," and declared that he had neither made the remark nor expressed the sentiment in his Mineralogy of 1854. (Amer. Jour. Science, February, 1872.)

Two questions were here involved, namely, the personal views of Mr. Dana, and those of the school in question; but he began by denying, alike for himself and for others, their well known and avowed teachings. To all this I replied by showing that each one of the alleged cases of rock-alteration had been expressly maintained by one or more writers of the school. I showed, moreover, as regards Prof. Dana, that he had repeatedly, from 1845 to 1858, asserted that the various pseudomorphic changes maintained by Blum, Rose, and others, were true, not only of individual crystals, but of great rock masses; that in his Mineralogy of 1854, he described the epigenic production of serpentine and other magnesian rocks as "a process of pseudomorphism, or in more general language, of metamorphism," and added, that the "subject of metamorphism, *as it bears on all crystalline rocks*, and of pseudomorphism, are but branches of one system of phenomena." I farther showed that his assertion made in 1858, that "metamorphism is pseudomorphism on a broad scale," was but a summing up and a reiteration of his teachings of 1845 and 1854. Prof. Dana now admits this language to be his own, but pleads, in excuse, that the expression was a hasty one, which he had so far forgotten as to be unwilling to believe himself to have made use of it. To this point I shall return.

In his Manual of Geology, which appeared in 1862, we find but few traces of this doctrine; the origin of serpentine and steatite from the alteration of pyroxene rocks is taught, but, with this exception, the author is silent with regard to his late teachings on pseudomorphism, and I am now blamed because I did not interpret this silence as an evidence that he no longer held his former views. They were, however, nowhere repudiated nor retracted, and students of his Mineralogy might well be pardoned if, under these circumstances, they continued to accept the former repeated and emphatic utterances of Prof. Dana as his creed on the subject of rock-metamorphism. I confess that I had never been led to suspect any change in his views until after the publication of my address in 1871. Could I have deduced as much from the negative evidence afforded by his Manual of

Geology, I would gladly have stricken Prof. Dana's name from the list of the defenders of the doctrine of which he had so long been known as the champion, but which I have for the last twenty years opposed.

With regard to the numerous rock-transformations mentioned in my address, I nowhere charged Prof. Dana with explicitly maintaining them, although in view of his late earnest repudiation, alike for himself and for others, of supposed alterations of rock masses, I reminded him that by the principles which he had formerly laid down and defined, he was "logically committed to all the deductions as to the changes of rocks which the transmutationist school has drawn from the alterations of minerals," by following out the principles laid down by him in 1845, and later in his Mineralogy of 1854, to their legitimate conclusions.

Prof. Dana proceeds, in the American Journal of Science for February, 1875, to discuss the supposed conversion of granite or gneiss into limestone, a notion which he says never came into his head, and he accuses me (1) of stating that his "Mineralogy contains the fact that calcite is sometimes pseudomorphous after quartz," and (2) of charging him with maintaining the metamorphosis of granite or gneiss into limestone. Now *I have never anywhere asserted the one or the other.* I made no reference to his Mineralogy for the statement that calcite is pseudomorphous after quartz, for which my authority is the complete and elaborate memoir on Pseudomorphs, prepared by Delesse, and published in the Annales des Mines in 1859 [(5) XVI], to which I so frequently referred in my reply. We are there informed that *calcite* is pseudomorphous after *quartz*, *pyroxene*, *feldspar*, *garnet*, etc. As a deduction from this, I cite the conclusions, *not of Prof. Dana*, but among others, of Messrs. King and Rowney. These gentlemen, in the Annals of Natural History for 1874[1] (Vol. XIII, p. 390), go so far as to say that, "the Tyree, Aker, and other crystalline marbles, were originally silacid masses, and possibly much of the so-called limestones occurring in the Laurentian of Canada were in Archæan periods silacid members of true gneisses, diorites, and other related rocks"— changed by a process of pseudomorphism.

In writing the above paragraph, I have before me Prof. Dana's remarks in the American Journal of Science for February, 1875. In the Proceedings of this Society for last October, the statement is

[1] This, in my volume of Essays, is by mistake printed "1869."

slightly varied, and he only charges me with asserting that he had "virtually believed" in the transformation of granite or gneiss into limestone, as maintained by Messrs. King and Rowney. He, however, adds the remark, which serves to show his unfamiliarity with the literature of the subject, that as regards this supposed change of rocks, he "*never knew that any man was ignorant enough, or audacious enough to have suggested*" it.

Prof. Dana then proceeds to deny in an emphatic manner, *for himself*, certain opinions which he says I attribute to him and to others: 1. "The conversion of almost any silicate into any other"; for proof of which I refer to the table of pseudomorphs given in his Mineralogy for 1854, as well as the more complete one cited above; 2, 3, 4. The possibility of converting granite, gneiss or diorite, into limestone; 5, 6, 7, 8. The possibility of converting granite, granulite, gneiss and diorite, into serpentine; 9, 10. The possibility of converting limestone into granite and gneiss. Now these statements of his, in the American Journal for February last, are intended to convey only one impression, namely, that I have falsely charged both himself and others with holding these various transformations. Yet every reader of my address and of my reply to Dana's criticisms thereon knows: 1, that I never maintained that Prof. Dana has taught *explicitly* any one of these rock-transformations, and, 2, that I have shown by numerous citations that each and every one of them has been *explicitly* taught by eminent writers of the school in question, to which Prof. Dana belonged from 1845 to 1858, and to which, till his late declaration to the contrary, I still supposed him to belong.

As regards Prof. Dana's final assertion, in his notice of my Essays in the American Journal for February last, that, "with the exception of the year 1858, I have never held nor taught that metamorphism is pseudomorphism on a broad scale," he will permit me to refer to the teachings of his Mineralogy in 1854, cited above, and, moreover, to quote his own language in 1858 (Amer. Jour. Science (2) XXV, 445), where in discussing the question of metamorphism, Prof. Dana refers to his paper on Pseudomorphism, published in 1845 (ibid., (1) XLVIII), and says . . . . "on page 92 of the same paper metaphism is spoken of as pseudomorphism on a broad scale." It is clear, by his own showing, that this now forgotten and objectionable doctrine was not taught by him, as he now seems to say, for the first time in 1858, but was then cited by him with approval, as his teaching thirteen years before.

The President exhibited two specimens of porphyritic rock, evidently of a conglomerate character. He had been the first, as long ago as 1862,[1] to refer to evidences of metamorphic action in conglomerate rocks, which he had observed near Hingham, Mass., but was then unable to procure hand specimens. He believed the subject worthy of farther study.

Prof. Niles remarked that he had noticed similar cases in Wakefield and elsewhere in Massachusetts, and believed the phenomena to be general, and not local in character.

Wednesday, June 16, 1875.

President in chair. Eleven persons present.

Mr. S. H. Scudder exhibited to the Society some remains of insects occurring in carboniferous shale at Cape Breton.

They were all found upon a single small fragment of stone, and consist of wings of cockroaches (not very uncommon in carboniferous strata) and the well preserved remains of the abdomen of a larval dragon-fly.

Heretofore the earliest indubitable remains of dragon-flies have come from the Lias, several fragments of wings, as well as perfect wings, a head and part of an abdomen having been figured by Rev. Mr. Brodie in his work on the fossil insects of the secondary rocks of England. Goldenberg, however, figures[2] an obscure insect (of which he only says it is possibly a Termes, but to which, in a subsequent work he gives the name *Termes Hagenii*), which also is perhaps the larva of a dragon-fly; this was found in the carboniferous beds of the neighborhood of Saarbrücken in the valley of the Rhine. Further I exhibited to this Society some years ago, from the Carboniferous of Cape Breton, a photograph of a curious insect's wing which I called *Haplophlebium Barnesii*, and which had the general aspect of a dragon-fly's wing, but differed from it in several essential features; it is not impossible that the body now exhibited may prove

[1] These Proceedings, IX, p. 57.

[2] Dunker and Meyer's Palæontogr., IV, pl. vi, fig. 8.

the larva of that very insect, so much does it differ from the ordinary type of dragon-fly larvæ. The wing of Haplophlebium came from Little Glace Bay, Cape Breton, and was found by Mr. James Barnes. The abdomen now under consideration comes from Cossett's Pit, Sidney, Cape Breton, and from near the horizon of the Millstone Grit, as I am informed by Principal Dawson, to whom I owe the opportunity of studying this interesting fossil. The specimen was found by Mr. A. J. Hill. In both instances the insects are accompanied by fronds of Alethopteris, but of distinct species.

The following paper was read:—

Notes on the Noctuidæ. By H. K. Morrison.

In the following paper we describe a few new North American forms belonging to this family, and make some changes in the synonomy of the species. Several of the new species are remarkable additions to our fauna, especially the *Cucullia luna*, which is, perhaps, the most beautiful species of this handsome genus; the *Agrotis manifesta* is also a well marked insect, very different from our few species which have pectinate antennæ in the male. We are indebted for our material to the kindness of several well known collectors, to whom due credit is given after each species.

Mr. Herman Strecker, particularly, has given us free access to his enormous collection, and in this paper and succeeding ones, we give the results of our study of a portion of his Noctuidæ. Most of the species we describe from his collection will be figured by himself, in a short time, in his work on the Lepidoptera.

Dicopis electilis nov. sp.

Expanse, 37 mm. Length of body, 14 mm.

Palpi short, scarcely exceeding the front. Antennæ of the male "pyramidal toothed" (this is a term used by Lederer). Anterior tibiæ with a long slender claw, otherwise unarmed. Thorax heavy, and with coarse villosity; a distinct white band on each side of the tegulæ, which are black next to the wings. Abdomen short, dark and not untufted. Anterior wings cinereous gray, with the markings well defined; a very heavy black basal streak, including and extending beyond the claviform spot to the exterior line; ordinary spots concolorous, obsoletely encircled with black; interior line obsolete; exterior line distinct, black and narrow, with an indentation opposite the reniform spot, below which it is drawn in; subterminal line blackish, subobsolete. Posterior wings light gray; beneath gray, the posterior wings lighter, with discal dots.

Hab. Easton, Penn. From Mr. W. H. Stultz.

Distantly allied to *Dicopis muralis* Gr.; it differs in the shape of the wings, which are narrow and Cucullia-like, the presence of the basal streak extending to the exterior line, and the absence of the distinct subanal streak of *muralis*.

Agrotis digna nov. sp.

Expanse, 32 mm. Length of body, 14 mm.

All the tibiæ armed. Eyes naked. Palpi dark. Collar white above, the lower half gray. Thorax and abdomen white, anal tuft with a faint brown shade above. Anterior wings white, covered with very fine gray atoms, which, becoming thickened towards the outer margin, give it a dusky appearance; the markings are nearly obsolete, the interior and exterior lines are faintly seen, and two black dots mark the reniform spot; a black line at the base of the fringe. Posterior wings and fringes pellucid white. Beneath, the anterior wings are yellowish white, the posteriors without the yellow tinge, except on the costal margin.

Hab. Texas.

One specimen in the collection of the Peabody Academy of Science, and one in our own possession.

The white color of this species is different from that of *A. muræнula*, *simplaria*, and their allies.

Agrotis infracta nov. sp.

Expanse, 26 mm. Length of body, 13 mm.

All the tibiæ armed. Ovipositor of the female slightly protruding.

This species we have had in our collection for some time, but have considered it a small variety of *Agrotis messoria* Harris; it is extremely close to this species certainly, but we have seen a number of specimens, male and female, all showing the same characters, and some even smaller than the type; none approaching in size to *messoria*, which expands from 33 to 40 mm. The following are the differences of marking which it presents: basal dash distinct, ground color of the basal and subterminal spaces lighter carneous gray, exterior line more strongly projected outward, posterior wings nearly uniform dusky gray.

Hab. Colorado (T. L. Mead); Texas (Belfrage).

Agrotis claviformis Morr. Proc. Bost. Soc. Nat. Hist., Vol. XVII, p. 162, 1874.

Our type of this species was a female; a short time ago we received the male from Prof. C. H. Fernald of Maine, and we are thereby enabled to give descriptions of both sexes.

Anterior tibiæ spinose. Antennæ of the male strongly pectinate. Collar and prothorax whitish, metathorax brown. Second joint of the palpi brown on the sides, above white; third joint brown. Anterior wings brown; the subterminal and basal, and the anterior portion of the median space, overspread with light gray; claviform spot brown, and very noticeable; median shade distinct brown, and angulate in the middle; orbicular spot concolorous, the reniform crossed by a red stain; exterior line dentate, not very strongly marked; terminal space dark. Posterior wings brownish gray, with whitish fringes, having discal dots and two indistinct median lines. Beneath gray, sprinkled with brown; a common median line and discal dots.

Hab. Massachusetts, Maine.

Agrotis manifesta nov. sp.

Expanse, 38 mm. Length of body, 18 mm.

Anterior tibiæ spinose. Antennæ of the male strongly pectinate, of the female simple. Anterior wings gray, with very simple and evident ornamentation; half line obsolete; interior line simple, black, perpendicular, and slightly irregular; the ordinary spots are reduced to black dots, the orbicular is sometimes absent, the reniform is present in the five specimens we have seen; the exterior line is of the usual form, distinct, simple and finely dentate; subterminal line nearly obsolete; fringe slightly darker than the ground. Posterior wings fuscous gray, with distinct discal dots. Beneath gray, with discal dots and common median lines.

Hab. New York. In May.

Described from specimens in the collection of Mr. Fred. Tepper.

This species has some resemblance to *Agrotis manifestilabes* Morr., and has, like it, pectinate antennæ in the male sex. Its color varies considerably, in some specimens being mingled with brown. The orbicular spot is sometimes absent, and very possibly specimens will be found in which both spots are obsolete; in this case the species would resemble in simplicity of ornamentation, *Agrotis monochromatea* Morr., although the ordinary lines in the latter are thick, suffused and subparallel, as in the species of Ufeus.

Agrotis oblata nov. sp.

Expanse, 34 mm. Length of body, 13 mm.

Anterior tibiæ apparently non-spinose, but as the thorax and legs are somewhat rubbed, it is possible that the spines have been lost. Anterior wings above with a fine, black, basal streak; interior line brown-black, preceded by a light line which bounds the purple-gray basal space; claviform spot small, black encircled and concolorous; median space brown, much darker between the ordinary spots; the latter are light brown, contrasting, and with black annuli, the reniform spot with a central light line; the exterior line of the usual shape, dentate and indistinct; the purple-brown subterminal space contrasts strongly with the yellowish terminal space; the subterminal line is shown only by the contrast of the two colors. Posterior wings with faint discal dots and a scarcely perceptible median line; their color is yellow, deepening into brown towards the outer margin. Beneath almost immaculate, yellowish, tinged with reddish brown towards the outer margin. Anal tufts yellow, brown above.

Hab. Anticosti Island. From the collection of Mr. Herman Strecker.

We have compared this insect with Drs. Möschler and Staudinger's descriptions of Labradorian Agrotids, and it appears to be a distinct species.

Agrotis chardinyi Bdv.

Agrotis gilvipennis Grote. Sixth Ann. Rep. Peab. Ac. Sc., p. 28.

Mr. Strecker, in his work on exotic and native Lepidoptera, correctly determines this species from Anticosti, and about the same time Mr. Grote described it under the name above mentioned. We have seen in Mr. Strecker's collection, and also have in our own, perfect specimens of our insect, as well as the Siberian *A. chardinyi*, and there can not be any doubt that they are the same; there is not even the usual slight geographical difference in color noticed by Dr. Speyer in insects common to Europe and America.

Prof. C. H. Fernald has sent us a fine specimen from Maine, which still further extends the range of the species.

Agrotis præfixa nov. sp.

Expanse, 42 mm. Length of body, 22 mm.

Tibiæ spinose. Eyes naked. Habitus and markings of *Agrotis occulta* Linn., but the wings are wider, and not so elongate. Thorax gray, mingled with white. Abdomen not tufted. Anterior wings light cinereous gray; half-line present; a distinct basal longitudinal dash; interior line dark, geminate, and nearly straight; the claviform spot large, black, and distinct; the space between the ordinary spots blackish; the spots are very large, subquadrate, white and contrasting, and with continuous black annuli; median shade indistinct; the exterior line dentate, and not very well marked; subterminal line whitish, conspicuous, with two Hadena-like teeth, and preceded by a very black, conspicuous shade band; terminal space light; a series of black dots at the base of the fringe. Posterior wings whitish, somewhat iridescent, with a broad, black border. Beneath cinereous gray, with indistinct markings.

Hab. Rocky Mountains. From the collection of Prof. Julius E. Meyer. This species belongs to the *Eurois* group of Agrotis.

Mamestra repentina nov. sp.

Expanse, 32 mm. Length of body, 15 mm.

Eyes hairy. Abdomen with a single middle dorsal tuft. Thorax gray, mottled with black. Collar with a transverse black line. Anterior wings light gray, with all the lines and spots present; half-line distinct; the interior line black, lobate and geminate, the median shade very wide, black and dentate, running between the ordinary spots; claviform spot small, black and linear; the ordinary spots light and contrasting, the orbicular round, the reniform larger, kidney-shaped; the median space is olivaceous green; the exterior line is dentate, of the usual shape; a dark shade on the costa before the subterminal line; the latter is but little distinct, preceded by a few isolated black spots; the geminate lines all enclose yellowish shade lines; the fringe bicolorous, yellow and white, and with the outer white portion checked with black. Posterior wings gray, lighter at the base. Beneath gray, nearly unicolorous.

Hab. West Hoboken, N. J. From the collection of Prof. Julius E. Meyer, of Brooklyn, N. Y.

Allied to *Mamestra palilis* Harvey, but the better defined markings and the different colors of the ground will separate it.

Mamestra ectypa nov. sp.

Expanse, 30 mm. Length of body, 14 mm.

Eyes hairy. Abdomen of the male short, with only a small dorsal tuft on the basal segment. Palpi well clothed, of the ordinary form in this genus. Thorax dark, concolorous with the anterior wings; the collar with a black, transverse line above. Anterior wings dark olivaceous gray, with all the markings very distinct and conspicuous; half-line present; interior line geminate, black and well-lobed, enclosing a bluish shade line; the ordinary spots of usual size, lighter than the ground, and therefore distinct; the reniform with a blue central shade; the claviform spot present, large and black; the exterior line simple, distinct and dentate, followed by a bluish subterminal space; the subterminal line evident, yellowish and irregular, preceded by black cuneiform markings partially united together, and followed by the fine lobate black line at the base of the concolorous fringe. Posterior wings uniform dark gray. Beneath uniform gray, with discal dots on the posterior wings.

Hab. West Virginia. From the collection of Prof. Julius E. Meyer.

Quite distinct from the numerous known species of the genus, and looking like a large species of the subgenus Miana, common in Europe.

Mamestra lubens Grote. Trans. Am. Ent. Soc., 1875.

Mamestra rufula Morr. Proc. Ac. Nat. Sc. Phil., 1875.

Mamestra brassicæ Grote. List of N. A. Noctuidæ, 1875.

Mr. Grote's paper has priority over ours by a few days, and therefore his name should stand for the species.

Mamestra rugosa nov. sp.

Expanse, 34 mm. Length of body, 16 mm.

Eyes hairy. Antennæ of the male pubescent. Collar with a black transverse line. Abdomen yellowish, with the anal tuft reddish. Color of the thorax and anterior wings clear bluish cinereous gray; a black basal dash; interior line oblique, even, bearing the black edged claviform spot and a quadrate dark brown spot, which precedes the orbicular; upper part of the basal and subterminal, and the entire median and terminal, spaces shaded with brown; the veins in the median space are whitish and distinct; ordinary spots whitish and contrasting, the reniform with a central brown shade, the space between them deep brown; a series of brown dots before the subterminal line, which is only apparent by the great difference in color between the terminal and subterminal spaces, the subterminal teeth barely perceptible. Posterior wings clear yellow, with discal dots and a broad black border. Beneath yellow, shaded with brown; discal dots, and a subterminal common brown shade, becoming black near the anal angle of posterior wings.

Hab. Maine. From Prof. C. H. Fernald, of Orono.

Allied to *Mamestra chenopodii* Albin.

Segetia mersa nov. sp.

Expanse, 38 mm. Length of body, 16 mm.

Eyes naked. Abdomen with only a small tuft at the base. Anterior wings gray, mottled with whitish, with all the lines and spots vague and ill-defined, as usual in this genus; the claviform spot black and distinct, the reniform spot white, of the usual shape; a yellowish spot on the subterminal line, just before the inner margin; a scalloped line at the base of the fringe. Posterior wings whitish, sprinkled with gray. Beneath gray, with a common median line and discal dots.

Hab. California. Collection of Mr. Herman Strecker.

This is a Californian species, allied to our common *Segetia luxa* Grote; it differs in the absence of the middle dorsal abdominal tuft, the more purely gray color, and the color of posterior wings, which are whitish gray, instead of black. No Californian Segetiæ have yet been described; it is possible that this insect has been described under some other generic name, although it is undoubtedly a true Segetia.

Nonagria læta nov. sp.

Expanse, 37 mm. Length of body, 23 mm.

Eyes naked. Front with a sharp, horny projection, covered with hair. Abdomen extremely long, with a pointed anal tuft, which conceals the long curved ovipositor of the female. All the head and body parts concolorous with the wings. Anterior wings brown, with a few longitudinal yellowish shades; all the veins dark purple-brown, contrasting; a blackish diffuse discal spot; fringe concolorous, having a slight darker shading at the base. Posterior wings gray-brown, lighter and yellowish at the base; fringe yellow. Beneath brownish yellow, the central portion of the anterior wings blackish; discal dots present.

Hab. Hoboken, N. J. From the collection of Mr. Herman Sachs.

This fine species is very well marked for this dull and inconspicuous genus. It differs in important particulars from M. Guenée's description of *Nonagria enervata*, ♂, from Florida; the sexes are so different in this genus that it is impossible to be certain, until this latter species has been rediscovered.

Heliophila pertracta nov. sp.

Expanse, 34 mm. Length of body, 16 mm.

Eyes hairy. Head and thorax concolorous with the anterior wings The latter are uniform yellowish salmon color, interrupted only by the median vein, which is white, as well as its second and third branches; the apical costal branches are also whitish. Posterior wings and under surface white, immaculate.

Hab. Philadelphia, Penn. Collection of Mr. Herman Strecker.

The description of this species is necessarily short, on account of the uniform tint, and entire lack of ornamentation. The remarkable color of the anterior wings, as well as the absence of all black markings, will at once separate it from *Heliophila phragmatidicola* Guen., to which it is allied.

Caradrina tarda Guen.

We have identified in the collection of Prof. Julius E. Meyer, of Brooklyn, N. Y., this species, which has hitherto remained unknown; it is a very well marked insect, and can not possibly be mistaken; however, we give the following short description, as none has yet been published in English.

Eyes naked. Thorax smooth, and closely haired. Abdomen short and untufted. Second joint of palpi black, the third white and contrasting. Ground color of the anterior wings dull gray-brown, as in *Pseudothodes vecors* Guenée; the ordinary spots apparently obsolete; the median lines distinct, simple and black, the interior line well-lobed, the exterior even and continued; the median shade subparallel with the exterior line, thick, black, and strongly curved in the middle (in this respect the species differs from M. Guenée's description, but it is a character liable to vary); the subterminal line yellow and conspicuous, preceded by dark shades; fringe concolorous. Posterior wings uniform fuscous gray. Beneath the wings are dark gray, and have the usual common median line, the posterior wings are slightly lighter, and have the discal dots.

Hab. West Virginia.

Caradrina derosa nov. sp.

Expanse, 33 mm. Length of body, 14 mm.

Eyes naked. Form stout. Thorax not tufted, its clothing short, but coarse and mingled with scales. Palpi short. Abdomen smooth, stout, not tufted. Tibiæ unarmed. Collar with an interrupted black line, otherwise concolorous with the thorax and anterior wings. The latter are gray, the color of *Agrotis messoria* Harris, the markings are black and indistinct; the half-line present; the interior line geminate, lobate and interrupted; the median shade present, running between the nearly obsolete ordinary spots, where it is thickened, forming a black spot; a series of light and dark dots on the costa;

subterminal line faint, but preceded just below the costa by several conspicuous, partially united, black cuneiform markings; a series of dots at the base of the concolorous fringe. Posterior wings white at the base, with a diffuse, broad, blackish border. Beneath the anterior wings are blackish gray, with discal dots and a double exterior line; the posterior wings are lighter gray, with small distinct discal dots, a well marked median line and a large black spot at the costal angle. Second joint of the palpi black and contrasting.

Hab. New Jersey. Received from Mr. W. V. Andrews, of Brooklyn, N. Y.

This species has the size, markings, palpal and abdominal structure and general appearance of the larger and stouter species of Caradrina, as *C. alsines* and *C. taraxaci*; it differs from them, however, in the villosity of the thorax and front, which in our species is mingled with scales, and therefore coarser. Perhaps this is ground enough for a generic separation, and if so, it can be made when other and better specimens have been discovered. At present the species appears to be very rare.

Cucullia luna nov. sp.

Expanse, 46 mm. Length of body, 21 mm.

The entire upper and under surface of the wings, the thorax, head, front, palpi and abdomen, of this lovely species, are glancing silvery white, as in the longitudinal space on the anterior wings of the Siberian *Cucullia argentina* Fabr.

The only traces to be seen of any other color appear as follows: on the inner margin of the anterior wings there are two small, distinct, black spots about seven millimeters apart; on the middle of the wings, a little further up, there are two similar but smaller dots, one above the junction of the median vein and fourth median veinlet; there is also another black spot on the costa at the base. The femora and tibiæ are white, but the tarsi are darker, and become nearly black at their termination. The usual hood is to be seen, but not quite so prominent as in many species.

Hab. Banks of the Yellowstone River, Dakota.

This superb species is from the collection of Mr. Herman Strecker.

Chariclea pretiosa nov. sp.

Expanse, 30 mm. Length of body, 13 mm.

Eyes naked. The anterior tibiæ in this specimen are absent, so that we can not observe whether they are armed or not. Front with a projecting tubercle, as in *Chariclea delphinii* Linn. Head and thorax yellow, an orange spot at the base of the antennæ; tegulæ and collar with orange bands. Anterior wings bright light yellow, with orange yellow markings; all the veins are strongly marked with orange yellow, and there are, likewise, several longitudinal lines of the same color between them; the ordinary spots are absent; the interior line and median shade are partially obsolete, and are principally represented by orange yellow shades on the costa; the latter however, is seen below it, following parallel with, and a short distance before, the exterior line; the latter is orange yellow, very distinct and even, it is strongly outwardly projected in the middle, and there nearly reaches the outer margin, reducing the subterminal and terminal spaces; the subterminal line is almost obsolete, the only trace of it is a slight shade near the apex; an orange yellow line at the base of the yellow fringe. Posterior wings lighter, glossy yellow, the veins are faintly streaked with darker yellow. Beneath glossy yellow, almost immaculate; there are very faint traces of a common median line, and there is a dark yellow line at the base of the concolorous fringe.

Hab. Leavenworth, Kansas. From the collection of Mr. Herman Strecker.

This fine Chariclea is entirely different from all the known species with which we have compared it in Mr. Strecker's collection.

Anthœcia arcifera Guen., Species Génèral, Vol. II, p. 184.

Anthœcia spraguei G. and R. Proc. Am. Ent. Soc.

We have seen at various times a number of specimens of this rare and pretty little species. From the examination of this material, as well as that in our collection, we are satisfied that *arcifera* is simply a female melanotic variety of the ordinary form *spraguei*. They are the same in every particular except the color of the posterior wings; in the first they are entirely black, in the second their base is yellow. The males all belong to the latter form, and we have seen at least one female of it; *arcifera* is, on the contrary, always female. *Anthœcia brevis* Grote, presents an analogous female variety, in which the posterior wings are black, although the usual form has them yellow at the base.

Schinia media nov. sp.

Expanse, 35 mm. Length of body, 13 mm.

Eyes naked. Front with a cup-like depression. Anterior tibiæ with a stout claw. Head and thorax concolorous with the anterior wings. Ground color of the latter olivaceous gray; interior line white, even and distinct, bent in the middle, and preceded by a slight bronze shade; in two of the specimens before us, there is in the middle of the median space a large, oblique, somewhat kidney-shaped, intense black spot; in the other two there is no trace of this spot; exterior line the same as the interior, acutely angulate above, as in *Polenta tepperi* Morr., and preceded below by a distinct bronze shade; a blackish triangular space before the apex; the whitish subterminal line is here distinct, but below it becomes obsolete. Posterior wings uniform olivaceous gray. Beneath gray, on the posterior wings lighter, particularly at the base.

Hab. Berks Co., Penn., and Leavenworth, Kansas. Collection of Mr. Herman Strecker.

This, as well as the other species of Schinia, is so strongly marked that it will be quickly recognized if captured.

Polenta nov. genus.

We separate this genus from the typical Schiniæ, to contain the species described by us as *Schinia tepperi.* Our type of this species had lost the anterior tibiæ; we supposed that they were armed, as are those of other similar species, but the discovery of fresh specimens show that they are plain. This is the principal character on which we separate it generically, as in other structural points there is but little difference, although the markings and general appearance are quite different, as will be seen from our original description.

Tarache obatra nov. sp.

Expanse, 17 mm. Length of body, 7 mm.

Closely allied to *Tarache candefacta* and *tenuicula.* The thorax and basal space of the anterior wings dark yellow, unmarked. With the exception of the brown terminal space, and a broad yellow costal band, extending from the apex (where it connects with the terminal space) to the middle of the median space, the other portions of the wings are dead black; the exterior line is strongly projected outward in the costal light space; below it runs across the black region, and then, as well as above, it is preceded by a more or less distinct brown shade. Posterior wings blackish. Beneath the anterior wings are black, having the base and costal apical portions yellowish; posterior wings yellowish gray, with traces of a median line and of a terminal gray band.

Hab. Louisiana.

The peculiar markings of this insect will at once distinguish it, although its close relation to the species mentioned above is very evident.

Syneda graphica Hübn., var. *media* nov. var.

Of the variety to which we give the name of *media*, we know but two specimens; one in our own collection, taken by Mr. T. L. Mead, and one in that of Prof. Julius E. Meyer; both of these insects were caught in Florida.

The markings of the anterior wings of these specimens are so constant, and they differ so much from the typical *Syneda graphica*, that we would think they formed a species apart, were not the posterior wings and under surface precisely the same in both forms. The following are the differences between them, the material consisting of two *media* and about twenty *graphica*: In the former the anterior wings are uniform cinereous gray; the interior line simple, without a black accompanying shade; the median and subterminal spaces concolorous; the subterminal line only represented by a series of white dots; the black line at the base of the fringe obliterated.

Homophoberia nov. gen.

Antennæ of the male clothed with fine hair. Front flat. Palpi ascending, the third joint well marked. Thorax slender, clothed with mingled scales and hair. Abdomen long and somewhat flattened at the end; the last four segments have each a low, but distinct dorsal tuft, the one on the anal segment the largest. Legs long, unarmed. Wings broad and large in proportion to the size of the body, the anteriors with a well marked angle at the termination of the third median branch.

Homophoberia cristata nov. sp.

Expanse, 31 mm. Length of body, 15 mm.

Thorax concolorous with the anterior wings; the latter are glossy olivaceous gray, gradually deepening in color to the exterior line; this line extends obliquely from just before the apex to the inner margin; beyond, the subterminal and terminal spaces are light olivaceous gray, and strongly contrast; ordinary spots present, the orbicular obscured by the ground color, the reniform concolorous with the terminal space, and therefore contrasting; a series of eight costal subapical dots; an interrupted deep black line at the base of the dark fringe. Posterior wings uniform dark gray. Beneath yellowish gray, distinct discal dots on the posterior wings.

Hab. Hoboken, N. J. One specimen kindly presented to us by Mr. Herman Sachs.

We think this remarkable species allied to Phoberia, but it differs so much from all the Drasteroid genera that we are forced to separate it. It has also quite a strong superficial resemblance to the common *Azelina Hübneraria* Guen., a geometer.

Dr. T. M. Brewer exhibited a fine specimen of the *Tringa cornutus*, a species formerly common on the N. E. coast, but at present supposed to be of very rare occurrence. Mr. F. L. Tileston had, however, found it on Cape Cod, about May 20, in abundance, and had kindly procured the specimen on the table for the Society's collection. The thanks of the Society were voted to Mr. Tileston for the gift.

The following paper was presented in substance at the meeting of April 7, but received too late for insertion in the records of that meeting.

Propositions concerning the Motion of Continental Glaciers. By Prof. N. S. Shaler.

Ever since I have become convinced that the surface of North America, north of the parallel of 40°, was covered to a great depth by a mass of ice during the last glacial period, I have been constantly endeavoring to form a conception as to the nature of its movement. This problem, which has doubtless led many naturalists into similar difficulties, has, it seems to me, some light thrown upon it by the considerations I shall summarize in this paper. It is evident that the angle of declivity of the slopes over which the ice movement of the glacial period extended cannot account for the motion. There is, for instance, indubitable evidence that during the last glacial period the country between Cincinnati, Ohio, and the Laurentian Mountains, was deeply ice wrapped, and that at the same time we had a great amount of material from the Canadian section transported to the Ohio valley.

We also have evidence that the ice sheet furrowed the surface as if it had moved as a continuous, or tolerably continuous mass, and it has therefore been assumed, it seems to me hastily, that the behavior of a continental glacier must have been essentially the same as that of a valley glacier, *i. e.*, that it had a continuous movement from the innermost point to the border.

In the following considerations I hope to make it evident that this supposition of the continuous movement which should bring any particle of ice over a distance of say eight hundred miles from the Laurentian Mountains to the Ohio, is not necessary to the explanation of the facts.

Mr. James Thompson has already shown from theoretical considerations, that the influence of pressure in causing water to melt at lower temperatures than 32° Fahr., is considerable; his paper, too elaborate to be considered in detail here, leads to the conclusion that for each atmosphere of pressure the freezing point would be lowered by the amount of 0.0075 of a degree Centigrade. Now if we suppose the surface of any country to be buried beneath an ice sheet, it is clear that insomuch as a glacial mass of great thickness is generally nearly level on its surface, however irregular the earth beneath it may be, it follows that the pressure at different points on the floor of the glacier must vary more or less, according to the difference in depth between the highest and lowest points of the earth surface. Now assuming that the glacial sheet has a uniform temperature throughout its lower portion, the gradually increasing pressure as the ice continues to heap up, will bring about melting from the pressure alone at the base of the glacier. The amount of pressure necessary to bring about this melting will depend upon the normal temperature of the ice at the point of contact with the earth; if the temperature be assumed as 30° Fahr., then the ice must be about two miles thick in order to cause melting by the pressure alone. The probabilities are, however, that the temperature is generally nearer 32° than 30° Fahr., so that the mass of ice would have to be much less thick in order to bring about this melting action. It is hardly worth while to undertake calculations as to the precise thickness of required ice on this basis of reckoning; for the data are not sufficiently clear to admit of certainty as to the precise amount of pressure necessary to lower the melting point of ice of a given temperature. It is evident, however, that a thickness of ice may be readily attained which will cause ice having a normal temperature of 28° to 30° Fahr., to melt by pressure. Let us now consider what would be the effect of melting under these conditions. It is evident that inasmuch as the fluidity of any water melted by pressure depends upon that pressure being continued, the passage of this melted water upwards through the crevices of the ice would not be possible; water mounting through the crevices of the ice would at once have its pressure removed, and would freeze again. The movement would evidently have to be in the direction of the least resistance, or towards the section where the ice was thinner than at the point of melting. The actual amount of the movement possible to water under these conditions would be very small; but in the continual recurrence and cessation of strains these slight movements would integrate themselves into a steady transfer of water towards the border of the glacier. The occurrence of these meltings, and the accompanying change of volume in different parts of the ice sheet, would necessarily have the effect of continually altering the tensions in all parts of the mass; this change would be exceedingly favorable to the creation of a constant succession of tensions, and the consequent frequent melting and freezing of the water. One of the first consequences will be to reduce the aggregate friction of the base of the ice upon the earth, on account of the ice being essentially afloat whenever this melting occurs beneath it, the soldering of every crevice in the superincumbent ice being assured by the freezing of the water as soon as released from the superincumbent pressure. Another important effect would arise from the penetration of the earth to great depths by the glacial water injected by a pressure equal to the weight of the whole thickness of the ice sheet. If a reservoir of water was formed beneath the ice in any depression the result would be, in case of the long retention of the water that its temperature would become considerably elevated above the point at which it was made molten by pressure. If, now, the barrier separating this mass of water from a region of less pressure even be taken away, there would be a rush of water in that direction which might assume great importance as an erosive and transporting agent.

I have long remarked in the study of our American moraines that by far the larger part of the pebbles were water worn, and that scratched specimens even in regions high above the sea, where marine action was quite out of the question, and did not form more than one per cent., often not one tenth of one per cent. of the whole mass. It is well nigh impossible to account for this great abundance of rounded pebbles without supposing there were powerful currents of water beneath the glacial mass. It seems to me that the melting of the water by pressure, and the elevation of the temperature of this water by the heat generated by friction, or taken from the earth, would probably give us sufficient movement of water to produce continued or interrupted currents beneath a large part of the ice sheet. This will also help us to account for the formation of glacial basins, and for the deep valleys of the Fjord Zone, inasmuch as melting occurs on account of the pressure; the points where the ice is deepest will be the places where melting occurs most easily. Let us consider the condition of any rock lake-basin during the time when it was deeply covered with ice, and melting from pressure was taking place therein. This basin would be the seat of much more movement than the other parts of the glacier's base; the change in the condition of the water from solid to fluid would inevitably lead to a certain waste of the ice at this point, to a continued tumbling in of the ice from above, and to an incessant sliding of ice from the sides; these changes would, on account of the frequent alterations of the strains arising from the formation and breaking of arches over the area of melting, occur with a certain paroxysmal force. These frequent accidents in the glacial mass, together with the movement of the water driving before it sand and pebbles, would necessarily add to the erosion of the point where they occurred. For every increase in the depth of the excavation, there would be a proportional increase in the intensity of the melting, arising mainly from the deepening of the ice-section; but also, though in a comparatively small degree, from the greater heat in the bottom of the deepened pit, caused by its approach to the central heat. To this we may safely attribute the singular depth of many of the lake-basins within the Fjord Zone, the deeper they become the greater the forces leading to their deepening. The limit to this increase of the intensity of the deepening forces would be found in the formation of a pit on the surface of the ice just above the basin. The independence of movement in the bottom and upper parts of the glacier sheet would prevent the formation of a depression on the surface of the ice, until the area of the basin grew quite large. The important fact that all glacial lake-basins excavated in solid rock have their greatest length in the direction in which the ice stream moved, shows us that there was some necessary connection between the movement and the formation of the basin; this can be accounted for from the fact that the stream of water made fluid by the action of pressure, would necessarily flow off in the direction of the border of the ice sheet, while the principal supply of ice must come from the direction in which it was thickest. These two actions, arising from the entrance of the ice and its exit from the basin, may well account for the elongation of these lake-basins in the direction of the ice movement.

The advantage of this view over that which seeks to explain the erosion of those basins by the grinding of the ice alone, is, I think, manifest. The difficulty with the latter view is to account for the rise of the ice from the basin after its descent into it. The shearing action would necessarily lead to the flow of the upper level of ice over the part which was within the basin, leaving it locked within its walls. I do not mean to deny the value of this sort of excavating process, as shown in the theory so long and ably presented by Ramsey, Mortillet and others; I am inclined to think that it may have done much at certain stages of the ice action to dig out basins, but in many cases it is manifestly inapplicable. The lake-basins of central New York, for instance, cannot possibly be explained on this basis. We must bring in some agent tending to cause melting at the base of the glacial mass, in order to effect the excavation of such basins. I am inclined to think that the other class of excavations of the Fjord Zone, the valleys which do not sink into the pit-like depressions which form the lakes, may also be, in fact, accounted for by the operations resulting from melting under pressure, for the coursing of floods of water, released by pressure from its solid state, would prove a powerful aid to the excavating action of the ice.

By supposing that the principal transporting action of a continental glacier was accomplished by the water flowing beneath the glaciers, we readily account for the water-worn look which is so prominent a feature in the drift pebbles of the greater part of North America; even when their position makes it clear that they have never been worked over by water since they were left by the glacier.

By this theory we can account for the excavation of such great lake-basins as those occupied by the fresh water seas of North America. These basins, by their trend, and by their distribution over a region where they cannot be explained by simple ice-erosion, present an insuperable difficulty to any view which does not admit that running water was largely concerned in their production. On the hypothesis here brought forward, we can, it seems to me, account for their formation. The sheet of ice which had its southern border on the Ohio, at Cincinnati, doubtless leveled over the great trough which separates the central part of that State from the Laurentian Mountains. This valley of the great lakes has a depth of at least six hundred feet below the table-land which separates the Ohio valley from Lake Erie. In this great depression we may have had melting occurring on a scale so vast as practically to arrest the southward movement of the ice, the sheet only overlapping in an unimportant way, and for a short part of the glacial period, the southward boundary of the valley. The southern discharge of these waters may have been in part through the river beds of the State of Ohio, but I am inclined to think that the larger part of the waste went to the eastward down to the valley of the St. Lawrence. This view I am, in a measure, compelled to take, on account of the relatively small amount of drift along the southern border of the glacial sheet in the State of Ohio. I do not believe that the excavated matter from the basins of the great lakes is represented in the delta of the Mississippi, nor in the surface-deposits of the country to the south of their southern border. When we look for this waste we possibly find it in the vast mass of the Newfoundland Banks, which seem to be a huge submerged moraine, or delta, which never could have been formed by the transporting power of the St. Lawrence acting as a river. In this fashion we may possibly account for the production of basins extending east and west, like the great lakes.

The question will be fairly asked, how it is possible for an ice-sheet to have produced striæ across the whole continent, from the Arctic Circle to the Ohio, unless it moved continuously over the whole of this long path? This may be answered as follows: If we suppose the retreat of the glaciers to have been accompanied by a true forward glacial movement of the region near the edge of the sheet, we would have every part of the glaciated area in turn subjected to the scratching, without the difficulty of supposing that there was a continuous motion over thousands of miles. I do not deny that the ordinary form of glacial motion took place along all parts of the border of the glacial sheet for many miles, but to assume that this movement took place in the basin of Lake Erie, while the glacial front was at Cincinnati, seems quite unnecessary. I do deny that there is any such terminal moraine along the southern border as is required if we suppose the movement to have been continuous from the centre of the sheet to the border. The whole of the facts may be accounted for by supposing that there was a motion near the border of the ice, possibly for many miles therefrom; but we are not required to suppose more than this. Local movements of considerable strength there would undoubtedly be within the mass of the glacier, and as long as these occurred near enough to the border to make the relief easier in that direction, they would doubtless tend that way, but we must always remember that scratches alone give very insufficient evidence of the nature and extent of glacial movement; at best, they show us the direction of the very last movements that took place before the ice disappeared. Other erosion marks, like "crag and tail," doubtless tell more; but these features are probably the product of many successive glacial periods, and not of the last alone. The evidence to my mind is irrefragable that this region had its essential topographical features, all its valleys and fjords, before the last ice time. Undoubtedly, in many successive periods we may have had enough wearing applied to the hills to give them their form.

Some years ago I endeavored to account for the erosion of lake-basins of the glacial period by the melting of the ice beneath the glacier from the outflow of internal heat. This clearly is an insufficient cause to explain all the action, but I still believe it to have been a true cause. Taking J. D. Meyer's computation, and supposing that the waste of heat from the earth's interior is two hundred cubic miles per diem, one-half from volcanoes, there will be about one foot of ice melted beneath the continental glacier each year; as this heat will escape principally in the bottom of the valleys, it will directly coöperate with the pressure melting. As long as the water remained in the shape of ice, the escape of heat from below would be in a measure retarded; the instant a part of this ice was melted into water the escape of heat from the earth would be greatly aided, and would become very rapid, and in this way the continued fluidity of ice rendered liquid by pressure, would be secured.

These propositions may be briefly summed up as follows:—

1. That the melting caused by pressure would put a limit to the accumulation of ice at a depth of probably not exceeding two miles; probably much less.

2. That while the ice resisted the passage of heat from the earth, the water would favor this action, and so enable the water, fluid from pressure, to move to regions having a considerable less pressure.

3. Some melting would take place beneath the ice from the heat of the earth alone; this would, in itself, be sufficient to produce considerable effects.

4. The melting from pressure would give the ice-sheet a chance to move freely in the direction of least resistance. The water would not be able to rise through the unmelted ice on account of the removal of the pressure, to which it owes its melting.

5. The flow of water, more or less spasmodic and flood-like, towards the border of the ice, would suffice to carry away the rain-fall of the region, and to push forward pebbles to great distances; it would account for the stratification of moraine matter far above the sea, and for the rounding of pebbles.

6. The scoring of the rocks, which gives evidence of movement and of the direction whence it came, are necessarily the work of the

retreating ice sheet, and give no proof of the condition during the time of its widest extension.

I should say that I have attentively considered the theory so ably presented by Mr. James Croll, wherein he seeks to explain the movement of glaciers by the successive melting of molecules of water in the passage of heat through the ice. I am not prepared to deny that it may account for the motion of local glaciers, but deem it quite insufficient to show us how the ice movement could carry the snow formed a thousand miles north of the Ohio down to that river. Moreover, as I before stated, I am satisfied from the paucity of the moraine matter in southern Ohio and the neighboring region, that the movement had no such continuity as leads to the formation of a terminal moraine of a local glacier.

When the Humboldt glacier, and the other ice sheets of Greenland, come to be studied with care, I am inclined to believe that the great streams of water which issue from beneath them will be found to owe their origin not alone to surface-melting, but also to the action of pressure-melting, and the melting from the passage of heat from the earth's interior into the ice mass.

October 6, 1875.

Vice-President, Mr. S. H. Scudder, in the chair. Thirty-two persons present.

The following papers were read: —

Note on some Diptera from the Island Guadalupe (Pacific Ocean), collected by Mr. E. Palmer. By C. R. Osten Sacken.

I deem it my duty to place on scientific record a notice of some Diptera from a very unfrequented locality, the Island Guadalupe, situated in the Pacific Ocean, two hundred and twenty-five miles southwest of San Diego. They were collected by Mr. E. Palmer, who spent there some time in the spring of 1875, on scientific duty. These specimens were not pinned, but preserved dry in pill boxes. I pasted them on slips of cardboard, stuck upon pins and deposited the collection, for future reference, among the exotic Diptera of the Museum of Comparative Zoology. Most of these specimens are forms which are almost identical in all parts of the world. Some of them, however, are characteristic enough to indicate at some future time the affinities of the fauna. Such are, for instance, Tipula (No. 1 of the list); Syrphus (No. 4); Lispe (No. 5); perhaps also the fly No. 9. Unfortunately, our meagre collections of Diptera from the Pacific coast prevent me from attempting a comparison at present. Among the few insects of other orders, however, in the same collection, there was a Hemerobius, which Dr. Hagen was able to identify as *Micromus* (*Berotha*) *flavicornis* Walker, a species also received from Pennsylvania, Georgia and Kentucky.

The collection was divided in two lots, dated March 20 and April 22. Many of the species occurred in both lots.

List of the Specimens.

1. **Tipula**, ♂, of the ordinary type of the *Tipulæ lunatæ*, and with peculiar brush-like appendages of the hypopygium; two females, although somewhat darker in color, probably belong to the same species. (One specimen, March 20, another, and the females, April 22.)

2. **Bibio**, ♂, small, black, with whitish pile; a single specimen (March 20).

3. **Tachytrechus**, ♀. A single specimen (April 22), apparently belonging to this genus.

4. **Syrphus**, of the group of *S. affinis* Say, or *S. lapponicus* Zett. Five specimens of very different sizes, but apparently of the same species (April 22).

5. **Lispe**, one specimen (April 22).

6. **Musca domestica**, several specimens (both dates).

7. **Lucilia** sp., several specimens (id.).

8. **Sarcophaga**, two specimens (March 20).

9. " another species (March 20).

10. **Anthomyiæ**, several specimens (March 20).

11. **Drosophila** (?), antennæ broken (March 20).

12. **Scatella**, numerous specimens (March 20).

Of other orders, I found in the lot the above-mentioned Hemerobius, Psocus, Aphis (Lachnus?), Psylla (Trioza?), Ophion.

On the North American Species of the Genus Syrphus (in the narrowest Sense). By C. R. Osten Sacken.

Among the preliminary work to be gone through before the publication of my intended new Catalogue of the North American Diptera, I met with the necessity of settling the nomenclature of some of the native species of the genus Syrphus, the most common of which, until now, remained unnamed or badly named in collections. I take this genus in the sense of Schiner, that is, excluding with him Melanostoma, Platychirus, Xanthogramma, Pyrophæna, Didea, and Mesograpta (Lw.). Of the genus thus restricted, I discuss the ten species hitherto found in the United States, all of which occur in New England.

The Syrphidæ are among those families of Diptera in which a large number of species, common to Europe and to North America, occurs. Of the ten species which form the subject of the present paper, six[1] are identical, or very nearly so, with European species. Two of these have been described under new names for America (*S. geniculatus* Macq. = *umbellatarum* Lin.?, and *S. diversipes* Macq. = *cinctellus* Zett.?); two others I have described under new names, for reasons to be given hereafter (*S. torvus* = *topiarius* Zett.; *S. rectus* = *ribesii* Lin. ?); two again I considered sufficiently identified to retain them under their European names, (*S. abbreviatus* Zett., and *S. lapponicus* Zett.). Of the four [2] remaining species which, as far as I know, are peculiar to the American continent, two have been described before (*S. Lesueurii* Macq. and *S. americanus* Wied.) and the two others I have not been able to identify and therefore describe them as new (*S. contumax* and *S. amalopis*).

This comparatively small number will probably soon be increased by new discoveries. Still, considering the extent to which the country has been ransacked already, the increase cannot be expected to be very large. Dr. Schiner enumerates forty-five species of Syrphus for Austria, and some twenty more for the rest of Europe. The numerical difference in this respect between the two faunas is very

[1] More probably seven; *S. Lesueurii* seems to occur in eastern Europe; I saw a specimen, labelled "Silesia," among some Syrphi from Dr. Zeller's collection, now in Boston, which, apparently, belongs to that species (compare below).

[2] Or three; about *S. Lesueurii* see the note above.

remarkable, and there are not many groups of Diptera in which a similar difference exists. America possesses, it is true, in the allied genus Mesograpta, a peculiar form of its own, which seems to flourish especially in the tropics; still the number of species of this genus is by far not sufficient to balance the large number of European Syrphi.

The most troublesome problem I had to deal with in preparing the present paper, consisted in the discrimination of the species representing in America the European *S. ribesii* and *S. topiarius*. After carefully examining about three hundred specimens (most of which recently taken, and therefore in good condition for a delicate examination of this kind), I have succeeded in distinguishing two forms, which may be defined as follows: —

♂, ♀. Eyes pubescent; hind femora black, except at the tip.
S. torvus (Syn. *topiarius* Zett.)

♂, ♀. Eyes glabrous;
♂, all the femora black at the base; hind femora black, except the tip.
♀, all the femora yellow from the very base (the coxæ being black); hind femora usually with a brown ring before the tip. . . . *S. rectus* (Syn. *ribesii* Lin. ?)

S. rectus is very variable in size, in both sexes, while *S. torvus* varies much less. The number of minor differences, taken from all parts of the body, sufficiently establish the distinctness of these two forms. In all other respects these forms are most remarkably alike, and an unpractised eye would probably fail to detect any difference. (For the details, see below, the description of *S. rectus*.)

As *S. torvus* and *S. rectus* occur in the same localities, for instance, in the White Mountains, from the early summer till late in autumn, the question arises whether they occur promiscuously, or at different seasons? Unfortunately, the specimens which I examined were not all dated,[1] but, from the dates in my possession, it seems to result

[1] Mr. B. P. Mann collected about sixty specimens on the 7th of July, 1874, in the subalpine region of Mt. Washington; they were all *S. torvus*, except two or three females of the other form. Mr. Morrison, who collected in the White Mts. for two months, brought home about fifty *torvus* and one hundred and sixty *rectus*; his specimens were not dated; he remembers, however, that flies of this kind after having been very abundant, became scarce for a time, after which they became abundant again. The specimens of *S. rectus* of my own collecting are mostly dated from August and September.

that *S. torvus* principally occurs earlier, and *S. rectus* later, in the season. Thus the idea naturally suggests itself to my mind that we have here a case of so-called *seasonal dimorphism*, and that *S. torvus* and *rectus* are but two forms of the same species.

More than ten years ago, Mr. A. W. Malm (in his Anteckningar öfver Syrphici, Göteborg, 1863) expressed the opinion that the three European species, *S. topiarius* Zett., *ribesii* and *vitripennis*, are but varieties of the same species, each occurring more abundantly at a particular season, *topiarius* in the spring, *ribesii* in midsummer, *vitripennis* in autumn. But Mr. Malm finds passages between these European forms, which prevent their separation as species (for instance, an occasional presence of hairs on the eyes of both *S. ribesii* and *vitripennis*), while my researches have resulted in the definition of two absolutely distinct forms, which, but for the hypothesis of seasonal dimorphism, might be considered as separate species.

The intermediate form, *S. vitripennis*, which exists in Europe, has, in most cases at least, glabrous eyes, but, at the same time, in the female, dark hind femora, yellow only at the tip. I have not met with a corresponding form in America. In a careful scrutiny of more than one hundred and fifty North American female specimens, I have not found a single one combining glabrous eyes with dark hind femora. My material, however, was principally derived from New England, and especially the White Mountains. It remains to be seen whether collections made in more southern or western localities will not modify in certain respects the results thus far reached by me.

The European species of *S. ribesii*, which I have been able to compare with specimens of *S. rectus*, are indistinguishable from them. But whether the smaller varieties of the latter, for instance, the female specimens with a brown ring on the hind femora, also occur in Europe, I do not know.

The interest attached, in the recent developments of natural science, to *varieties*, in connection with the doctrine of evolution, gives the further investigation of the history of *S. ribesii* and its North American forms, an importance reaching beyond the scope of descriptive entomology. Without pretending to have brought that investigation to a final conclusion, I hope that the hints thrown out by me will not be lost to collectors.

Analytical table of the species of Syrphus described in the present paper.

A. Abdomen oval, with three principal crossbands, the second and third of which never interrupted.

I. First crossband broadly and distinctly interrupted in both sexes.

a. Femora black at the base.

aa. Antennæ brown, with more or less reddish on the underside of the third joint; abdominal crossbands distinctly attenuated on both sides.

Eyes pubescent.[1]

1. **S. torvus** n. sp.

Eyes bare.

2. **S. rectus** n. sp. male.

bb. Antennæ uniformly black; abdominal crossbands straight, not attenuated at both ends.

3. **S. Lesueurii.**

b. Femora yellow at the base.

2. **S. rectus** n. sp., female.

II. First crossband narrowly interrupted in the male; not interrupted in the female.

a. Face yellow.

4. **S. abbreviatus.**

b. Face with a brown stripe.

5. **S. americanus.**

B. Abdomen oval, the three principal crossbands broadly interrupted.

I. Eyes distinctly pubescent.

a. Abdominal spots straight; face without any large, conspicuous black spot in the middle.

6. **S. contumax** n. sp.

[1] The pubescence of the eyes is easily perceptible in male specimens; in the females it is generally much rubbed off, and often almost imperceptible. Still, a careful examination in an oblique light, especially of the lower half of the eye, does not fail to reveal some traces of hairs, if there ever were any. Fortunately, the females of *S. torvus* and *rectus* offer, in the coloring of their femora, a distinctive character, which is much easier to perceive. Specimens subjected to such investigations must not be too old; those kept for years in a collection become covered with a fine dust, which makes it very difficult to perceive whether the eyes are hairy or glabrous.

b. Abdominal spots coarctate in the middle, sometimes broken in two; a large, conspicuous black spot in the middle of the face.

7. S. amalopis n. sp.

II. Eyes bare; abdominal spots lunate.

8. S. lapponicus.

C. Abdomen elongated, narrow, linear.

I. First crossband interrupted, the others entire.

9. S. diversipes.

II. All crossbands interrupted.

10. S. geniculatus.

1. S. torvus n. sp.

Syrphus topiarius Zetterstedt, Schiner, Bonsdorf, Malm, etc. (non Meigen).

Female. Face and cheeks yellow, with a very slight bluish reflection; a faint grayish spot on the cheeks, under the eyes; oral edge, in the middle of the notch, usually slightly brown. Front and vertex greenish black; the former, on both sides along the eyes, with a broad border of yellowish pollen, almost meeting the similar border of the opposite side. Eyes pubescent (in many specimens the pubescence is very much rubbed off, and very difficult to perceive). Antennæ inserted on brownish yellow ground; the dark color of the front begins immediately above their root, forming a blackish brown arch, with a projecting angle in the middle. Antennæ dark brown; third antennal joint more or less reddish below, sometimes altogether dark brown. Thorax greenish, with but little lustre; in well preserved specimens a faint tinge of a geminate, grayish, middle stripe is perceptible anteriorly; scutellum dull yellowish, with a slight bluish reflection and black pile. Yellow spots on the second abdominal segment elliptical, prolonged usually as a narrow neck, which reaches forward and touches the margin; the yellow crossbands on the third and fourth segments have a very gently biconvex hind margin, with a very shallow, often indistinct, sinus in its middle; on each side the crossbands are attenuated and curved forward, so as to reach the anterior margin of the segment; the black interval between the stripes is twice as broad as the stripes. Fourth and fifth segments with yellow posterior margins, the fifth usually with two yellow spots on each side, at the base. Coxæ and basal third of femora black; on the hind pair the black reaches beyond the middle of the femora;

hind tibiæ often with a brownish ring; four anterior tarsi brown, the root of the first joint often reddish; hind tarsi dark brown. Root of the wings, as far as the humeral crossvein, slightly brownish or yellowish; costal cell almost hyaline; stigma brown.

Male. Similar to the female, but abdominal crossbands broader, the biconvexity on their hind side stronger, and the sinus in its middle deeper; the gray spot on the cheeks, under the eye, often larger, sometimes occupying a considerable portion of the cheek; the brown ring on the hind tibiæ usually expanded, so as to reach the tip of the tibiæ. The eyes are more distinctly pubescent, the front is beset with yellow pollen, except a narrow black space above the antennæ.

Length, ♂ ♀, 10–12.5 mm.

In drawing up the description, I had a large number of specimens before me. Among them was a lot of twenty-three males and thirty-five females, caught by Mr B. P. Mann, on the 7th of July, 1874, almost on the same spot, in the subalpine region of Mt. Washington. Another lot, of twenty-seven males and twenty females, was collected by Mr. Morrison, also in the White Mountains. Other specimens were from Massachusetts, Rhode Island, Canada, the Rocky Mountains in Colorado, etc.

This is the American representative of the European species, called *S. topiarius* by Zetterstedt, and after him by most of European writers. But it seems very doubtful to me whether these authors are justified in quoting Meigen as the authority for this species. Meigen's description of his *topiarius* does not agree with the species usually understood under that name. In order to keep clear from this uncertainty, I prefer to give a new name to the American species. Stäger (Greenland's Antliater, p. 360, 26) quotes *S. topiarius* among the insects of Greenland.

2. S. rectus n. sp.

? *Syrphus ribesii* Linné (et auctores).

♀. Eyes glabrous; hind femora yellow, often with a brown ring before the tip.

♂. Eyes glabrous; hind femora black, except the tip.

Female. Very like the female of *S. torvus*; the differences, as given above, consist in the entirely glabrous eyes and the femora, which are yellow from the very base (coxæ black); in most specimens the hind femora have a brown ring before the tip.

The size, as well as the shape, of the yellow abdominal stripes are very variable (the female of *S. torvus* shows, in both respects, much less variation). Between the following two extremes, all intermediate stages occur.

1. The smallest specimens, from 7 mm. upwards, in length, have the yellow stripes on the third and fourth segments quite straight, not attenuated before coming in contact with the lateral margin; their hind borders show no perceptible concavity or convexity; such specimens usually have a distinct brown ring on the hind femora, a little before the tip.

2. Larger specimens, up to 11–12 mm. long, have the stripes on the third and fourth segments with a distinctly biconvex hind margin, with a sinus in the middle; these stripes are distinctly attenuated on each side, before reaching the lateral margin. Such large specimens often have no brown ring on the hind femora.

Male. Differs from the female in the femora being black at base; the four anterior ones for about one third of their length; the hind ones altogether black or brown, except at the tip. The majority of the specimens before me are of medium size (about 8–10 mm.); but some larger ones also occur. The shape of the yellow bands does not vary as much as in the female; they always are attenuated at both ends and biconvex posteriorly, with a sinus in the middle. The altogether glabrous eyes easily distinguish *S. rectus* ♂, from *S. torvus* ♂; in other respects they look very much alike. The average size of *S. rectus* ♂, is a little smaller.

Minor differences between *S. torvus* and *S. rectus*, available for both sexes, are:—

1. The face under the eyes is altogether yellow here; there is no grayish spot, as is always visible in *S. torvus.*

2. The sides of the face in *S. torvus* is beset with very distinct blackish pile; in *S. rectus* this pile is of a pale color, and almost imperceptible; hence the face looks smoother.

3. The antennæ are less dark, more reddish in *S. rectus.*

4. The scutellum is of a slightly purer yellow.

5. The four anterior tarsi are less brown, more reddish, especially on the first joint.

6. The contact of the abdominal yellow spots and bands with the lateral margins, is slightly broader in *S. rectus*; hence, the yellow prolongation or neck of the spots on the second segment is broader, and, consequently, seems to be shorter.

7. The stigma of the wings is much paler, yellow rather than brown.

8. The metallic green thorax is somewhat more shining, less dull than in *S. torvus*; in many specimens, however, this difference is scarcely perceptible. The brown ring on the hind tibiæ, sometimes expanded so as to reach the tip, occurs in this species as often as in *S. torvus*.

I had about seventy males and ninety females for comparison, principally from the White Mountains; (a large lot was collected there by Mr. H. K. Morrison); also from West Point, Catskill, N. Y., Manlius, Western New York, etc.

Some rare specimens occur with a distinct brown stripe in the middle of the face; I found four such specimens, two males and two females, among my lot. Mr. Malm mentions a variety of the European *S. ribesii*, with all the crossbands interrupted. I have two such specimens from Fort Resolution, Mackenzie River, and from the Yukon River (both collected by R. Kennicott). As these specimens disagree in some minor characters also, I am not sure whether they can be taken for *S. rectus*.

I may mention here that the sexual difference in the coloring of the legs is not an exceptional character in this species; in *S. abbreviatus*, as will be shown below, the same difference exists.

Observation I. This is the representative of the European *S. ribesii.* No European author mentions the difference in the color of the hind femora of male and female as it exists in American specimens; this silence would authorize the belief that such a difference does not exist.[1] And yet, the few female specimens of *S. ribesii* which the Museum of Comparative Zoology possesses, among them a specimen labelled by Mr. Loew himself, all have yellow hind femora, while in the males they are dark. The most common species are the very ones which are often the least known and worst described, and this may have been the case with *S. ribesii.* In comparing the statements of different authors about this species and *S. topiarius*, a great want of agreement, as well as of precision, becomes apparent. And it may very well have occurred that the dark legged females of *topiarius* passed for females of *ribesii*, whenever the pubescence on their eyes was sufficiently rubbed off to render the mistake possible.

[1] Zetterstedt, Dipt. Scand., II, is the only one who has a statement bearing on this point. He says about *S. ribesii*: "femoribus basi in ♂ latius, in ♀ angustissime atris." But in the American specimens, as well as in the European specimens which I have seen, the coxæ are black, but there is hardly any vestige of black at the base of the femora in the female.

Observation II. It is the place here to mention two American species, described by previous authors, and compared by them to the European *S. ribesii.*

In comparing his *Scæva concava* with that species, Say must have had a female of the former, and a male of the latter, before him. Thus the distinction he establishes, "crossbands concave" in the American species, and "acutely notched" in the European, is a merely sexual difference, and not conclusive. The words "feet whitish, dull rufous at base," "head whitish cinereous, antennæ pale testaceous," do not agree with any Syrphus known to me.

Macquart's *S. philadelphicus* (Dipt. Exot., II, p. 93, a male) must be either *S. rectus* or *S. torvus*, it is difficult to decide which, as Macquart does not say whether the eyes are pubescent or not. It will perhaps be better to cancel for the present these two insufficient descriptions.

3. S. Lesueurii.

Syrphus Lesueurii Macquart, Dipt. Exot., II, 2, p. 93; *female.*

Epistrophe conjungens Walker, Dipt. Saunders., p. 242, Tab. VI, f. 5; *male.*

Will be easily recognized by Westwood's excellent figure of the male in the *Diptera Saundersiana.* Larger than *S. topiarius*, and with a much narrower abdomen; in the female the abdomen is a little broader, still less broad than in the allied species. The yellow face has a brown, abbreviated stripe in the middle (sometimes wanting); the antennæ are uniformly black. Eyes bare. The yellow spots and crossbands on the abdomen are straight, and reach the sides of the abdomen with their full breadth; the yellow has a bluish reflection (seldom indistinct); in the male the band on third segment has a sharp triangular notch in the middle of the hind margin, which does not exist in the female; the fourth and fifth segments often have a greenish reflection, and are margined with yellow posteriorly. The femora are black at the base, the hind tibiæ have a distinct brown ring. The wings usually have a distinct yellowish tinge.

Length 12–13.05 mm.; some rare specimens of both sexes are only 8 mm. long.

I compared about ninety male and female specimens, principally from the White Mountains (collected chiefly by Mr. Morrison); also from Maine, Massachusetts, Saratoga, N. Y., etc.

Macquart calls the thorax *black*, but so he does the thorax of his

S. philadelphicus; he evidently had soiled specimens. The thoracic dorsum here is more bronze color, less green than in *S. torvus*.

Among some Syrphi from the European collection of Dr. Zeller in Stettin, now belonging to Mr. E. Burgess in Boston, there is a specimen labelled "Silesia," which seems to agree in every respect with *S. Lesueurii*.

4. S. abbreviatus.

(Zetterstedt) Schiner, Fauna Austr., I, p. 311.

Male. Face yellow; cheeks black, which color coalesces with the brown oral border, and is connected, under the oral opening, with the black on the opposite side; in some specimens the facial tubercle is also brownish; third antennal joint brownish, more or less reddish on the underside, sometimes altogether reddish; front yellow; no brown spots above the antennæ; vertex blackish bronze-color. Eyes bare. Thoracic dorsum rather bright brassy green. Yellow spots on second abdominal segment rather large, obliquely triangular, touching the margin with the apex only; the interval between them moderately broad, equal to about one-third or one-fourth of the breadth of the spot; yellow bands on segments three and four rather broad, much broader than the black band between them; the posterior margin in both is sinuate in the middle, more markedly in the band of the third, than on that of the following segment; *the bands do not reach the abdominal margin*, and are cut off obliquely on the sides; the distance of their anterior corner from the margin is very small, however; fourth segment with a narrow yellow border posteriorly; fifth segment yellow, with a small transverse black spot in the middle, near the base. Legs yellow, *but base of all the femora black*; on the hind femora the black occupies one-third or one-half of the femur.

Female. Resembles the male, but with the following differences: lower part of the front, above the antennæ, yellow; upper part and vertex brownish green; oral border less infuscated, the infuscation being usually distinct in the middle of the excision only; the yellow spots on the second abdominal segment are larger, the interval between them narrower, often linear, sometimes obsolete; the bands on the third and fourth segments are comparatively narrower than in the male, and but little broader than the interval between them; their hind margins are gently concave-sinuate in the middle, and convex-sinuate each side; *both bands distinctly reach the abdominal margin*; fifth segment yellow, with a triangular black spot in the middle; coxæ black, but femora altogether yellow; (the four anterior femora in some specimens are black at the extreme base only; the hind femora are altogether yellow, thus widely differing from those of the male).

Length, ♂, ♀, about 8 mm.

Three male and six female specimens, all from Massachusetts.

The Museum of Comparative Zoology, in Cambridge, Mass., possesses a pair (♂, ♀) of European specimens obtained from Dr. Schiner, exactly similar to the American specimens; they also show all the sexual differences, as explained above. Zetterstedt's description (Dipt. Scand., VIII, p. 3136, 13–14, ♀) agrees very well with my female specimens. Schiner is certainly wrong in uniting *abbreviata* Zett. ♀ with *excisa* Zett. ♂; (Loew makes the same criticism in the Jahrb. d. K. K. Gel. Ges. in Krakau, Vol. 41, p. 16; only *excisa* should be read there, instead of *emarginata*).

Observation. In my Report on the Diptera of Colorado Territory (U. S. Geol. and Geogr. Survey, etc., by F. V. Hayden, for 1873, p. 564), I mention *S. corollæ* as occurring there. I was mistaken in this determination; the specimen is more like *S. abbreviatus*, although I would not, without further proof, identify it even with this species.

5. S. americanus.

Syrphus americanus Wiedemann, Auss. Zw., II, p. 129, 22.

Female. Face yellow, often brownish, *with a brown stripe* in the middle, which begins at the oral margin, but does not reach the antennæ; the latter brown, reddish on the underside of the third joint. Cheeks blackish, *but separated from the mouth by a narrow yellow border*, which, on the underside of the mouth, completely cuts off the connection between the black color on both sides. Front brownish bronze color, powdered with yellow on each side; the lower part of the front is more or less yellow, but immediately above each antenna there is a brownish spot, which sometimes coalesces with the bronze color of the upper front; vertex bronze color. Eyes bare. The first abdominal crossband is not interrupted, but coarctate in the middle; its ends do not touch the margin of the abdomen, but are separated from it by a narrow black border; (sometimes a brownish mark in the middle of this band gives it the appearance of being subinterrupted). The second crossband is nearly as broad as the black crossband between it and the next yellow band; it is usually perfectly straight; (in some specimens the hind margin is gently sinuate); its ends do not touch the lateral margin of the abdomen; they are cut obliquely, forming a sharp angle anteriorly, and a rounded one posteriorly; the former almost touches the margin of the abdomen. The third band is similar to the second, only its hind margin is more perceptibly arcuated. The posterior margin of the fourth segment has, as usual, a narrow yellow border, the fifth likewise, and two yellow spots at the base besides. Femora yellow; the four anterior ones in some specimens brownish at the extreme base only; the hind pair with a more or less distinct brown ring on the distal half; four anterior tibiæ and tarsi yellow; the hind tibiæ sometimes with a brownish ring, hind tarsi brownish.

Length, 9–10 mm.

Male. Front yellow, with a more or less distinct brown spot above each antenna; crossbands on the abdomen broader than in the female, and distinctly broader than the black interval between them; posteriorly, they are often nearly straight, sometimes distinctly arcuate, especially the third band. The yellow spots on the second segment are *not* coalescent, but separated by a narrow black interval (in some species subcoalescent); the fifth segment is yellow, with a black spot in the middle. The four anterior femora are black at the base; the hind femora are usually black, with a yellow tip; sometimes there is a trace of yellow at the base; hind tibiæ usually with a brown ring in the middle.

Length, about 9 mm.

Hab. British Possessions, New England, New York, Delaware, Virginia. In Detroit, Mich., in August, I found this to be the most common species. It seems also to be common in Texas (Waco, Texas; Belfrage). Sixteen males and eight females.

S. americanus ♀, differs from *S. abbreviatus*, ♀, besides being larger, in the presence of a brown stripe in the face, and of brown spots above the antennæ; in the spots of the second segment being altogether coalescent (instead of narrowly interrupted); in the crossbands not touching (or hardly touching) the abdominal margin, while in *S. abbreviatus* the contact is broad and distinct; in the crossbands being (in most specimens) more straight, less sinuate posteriorly.

S. americanus ♂, differs from *S. abbreviatus* ♂, besides being larger, by the brown stripe on the face, the more straight second crossband (less sinuate posteriorly) and by the coloring of the hind femora. In those specimens of *S. americanus* which have the hind femora altogether blackish, the yellow space at the tip is *narrower* than the yellow space in ordinary specimens of *S. abbreviatus*, ♂.

The yellow spots on the second segment (in all my ♂ *americanus*) do not touch the lateral margin; the black interval, although small, is distinct; in all my ♂ *abbreviatus* these spots distinctly come in contact with the lateral margin. The oral margin is not infuscated here (except, of course, at the point of contact with the facial brown stripe). Attention should also be paid, in both sexes, to the difference in the extent of the black coloring of the cheeks, as described above.

I hardly doubt that this is the *S. americanus* of Wiedemann. A doubt might arise on account of the allusion to this species which Wiedemann makes in his short description of *S. concavus* (l. c., p. 130, 24), from which it would appear that the crossbands of the present species *are notched*. I suspect that Wiedemann had Say's comparison of *S. concavus* and *ribesii* in mind, and inadvertently applied it to *S. americanus*.

6. S. contumax n. sp.

Male and female. Eyes distinctly pubescent; face with a bluish reflection, sometimes almost concealing the dull brownish yellow ground color; cheeks and oral border broadly black; front very broad in the female, black, clothed with grayish pollen; in the male with a bluish reflection; vertex greenish black, metallic. Antennæ black, inserted on brownish yellow ground; thorax greenish bronze color, with indistinct longitudinal stripes of an opaque brownish; dorsum beset with brownish, pleuræ with brownish fulvous erect pile; scutellum dull yellowish, with a bluish reflection. Abdomen black, very hairy, with three pairs of oblong, transverse, straight, brownish yellow spots, which, as a rule, do not reach the margin, but sometimes emit an indistinct prolongation anteriorly, which touches it; the last two segments are bordered with yellow; the pile on the abdomen, yellow and black, is, especially in the male, long, erect, and rather conspicuous. Femora (of the male) black on their proximal half, often beyond, hind femora up to four-fifths of their length; tibiæ brownish yellow; tarsi black. In the female the femora are black at their bases only. Wings hyaline, sometimes tinged with brownish; stigma brownish; third longitudinal vein nearly straight.

Length about 9.5 mm.

Hab. White Mountains, N. H.; I brought home three males; Mr. G. Dimmock gave me two females, labelled Mt. Washington, Alpine region.

The facial tubercle in this species is very salient, the whole lower part of the face somewhat projecting, the front of the female comparatively broad, the first joint of the hind tarsi of the male distinctly swollen. The general appearance of this species is different from an ordinary Syrphus; nevertheless the absence of any striking characters to take hold of renders the species difficult to describe.

7. **S. amalopis** n. sp.

Male. Eyes pubescent; face of a dingy brownish yellow, with a broad brown stripe in the middle (its breadth is equal to one-half of its length, or more); cheeks black, with a greenish reflection; a black, broad, oral border; antennæ black, front and vertex likewise; facial tubercle salient. Thorax dark metallic green, clothed with black pile, mixed with fulvous on the sides and near the scutellum; the latter dull yellowish brown, with metallic reflections, beset with black pile, and with a blackish border and corners. Abdomen black, very little shining, on the second segment two oblong yellow spots; on the third and fourth segments a pair of lunate spots, club-shaped on the inner end, truncate on the outer, and considerably excised in the middle; the fourth and fifth segments with a narrow, yellow, posterior margin; all the yellow parts are straw-colored. Legs black, tip of femora and base of tibiæ yellowish brown; the extent of this brown being much less on the last pair. Wings distinctly infuscated.

Female. Front and vertex metallic greenish black; spots on second segment coarctate in the middle, those on segments three and four dissolved in two, so that these two segments show each a transverse row of yellow spots, nearly of the same size and equidistant; the fifth segment has two spots at the base; the wings are hyaline. In all other respects like the male.

Length, ♂, ♀, 10–10.5 mm.

Hab. White Mountains (Gorham, N. H.). Two males and one female, taken by Mr. E. P. Austin and Mr. G. Dimmock.

I have not the slightest doubt that these males and females belong together; the difference in the coloring of the wings has no importance; as to that in the coloring of the abdomen, I should not wonder if this species proved to be very variable in this respect, and if intermediate stages occurred between that where the lunate spots are entire, and where they are dissolved in two. The abdomen in this species is more convex, broader and somewhat shorter than that of *S. lapponicus*.

In the specimens described above, the yellow abdominal markings do not come in contact with the lateral margin. But I have a pair of specimens (♂, ♀) from the same locality in which this contact occurs.

In the female the lunate spots are also cut in two, as they are in the typical specimens.

8. S. lapponicus.

S. lapponicus Zetterstedt, Dipt. Scand., II, p. 701, 3.

? *Scæva affinis* Say, Journ. Acad. Phil., III, 93, 9.

I compared ten specimens from the north-western regions of the British Possessions (R. Kennicott), from the White Mountains, N. H. (E. P. Austin, H. K. Morrison, and myself), and from British Columbia, which agree with Mr. Zetterstedt's description. A North American specimen of the same kind, sent to Mr. Loew, was identified by him as *S. lapponicus.*

A number of other specimens, nearly from the same localities, White Mts. (H. K. Morrison), British Possessions (Scudder), Quebeck (Bélanger) and Yukon River (Kennicott), have the third longitudinal vein less strongly sinuate, and show some other minor differences. The European *S. arcuatus* Fallèn differs from *S. lapponicus* in hardly anything but this very character, and is nevertheless considered a different species.

Scæva affinis Say (from Arkansas) does not seem to differ from *S. lapponicus* in any important character, and specimens from Delaware, Illinois, etc., which I have seen, may be identified with it. Thus the uncertainty whether I have one or several species before me, prevents me from giving a description.

Should it be proved that *Scæva affinis* Say, is a synonym of *S. lapponicus,* then Say's name, as by far the oldest, would have the priority.

Syrphus Agnon and *S. arcucinctus* Walker are either *S. lapponicus,* or some allied species; the descriptions are altogether unmeaning.

9. S. diversipes.

S. diversipes Macquart, Dipt. Exot. 4e Suppl., p. 155, 54 (Newfoundland).

? *S. cinctellus* Zetterstedt, Dipt. Scand., II, p. 742, 45.

Male and female. Abdomen narrow, with nearly parallel sides; first segment (♂) greenish black, with more or less yellow anteriorly, or on the sides; in the ♀ the yellow prevails, leaving only a metallic green spot on each side, which often is subobsolete; the following four segments have each a yellow crossband on their anterior half; the first crossband is broadly interru ted; in the male the interruption takes the shape of an inverted black triangle, expanding anteriorly so as to occupy nearly the whole anterior margin of the segment; in the female this triangle is narrow, and occupies but a small portion of the anterior margin; thus in the female the yellow of the crossband coalesces with that upon the first segment; the following crossbands are entire, the second and third nearly of the same breadth, and not attenuated on the sides; the fourth band, in the male, occupies nearly the whole segment, except a black semicircle posteriorly; in the female it occupies the anterior half of the segment, and is gently arched and distinctly notched posteriorly. Face yellowish, with a bluish reflection, sometimes brownish in the middle; above the antennæ a conspicuous black spot is surrounded by the yellowish pollen, which covers the rest of the front; antennæ reddish, upper half of the third joint, as well as of the preceding ones, brown. Eyes bare. Thorax metallic green; scutellum yellowish, with a metallic green reflection; humeri, and a part of the pleuræ, clothed with yellowish pollen. Legs yellow; outer half of the hind femora (sometimes nearly the whole hind femora, except the base), hind tibiæ and tarsi, brown; knees yellowish. Wings with a brownish shade on the apex, usually distinct in the female, often nearly obsolete in the male.

Hab. White Mountains (foot of Mt. Washington, end of June); Catskill Mountain House, in July; North Conway, N. H., in August; Lake Superior (A. Agassiz). Ten male and thirty female specimens. Two male specimens have the four anterior femora distinctly infuscated at the base. I entertain no doubt that this is the *S. diversipes* Macq., only in his description "pieds postérieurs noirs, à hanches *noires*," must read, "à hanches jaunes."

S. cinctellus Zetterstedt, is very like this species, and probably identical with it. His description agrees with the North American specimens. A European specimen in the Museum of Comparative Zoology, named by Dr. Loew, does not show any difference worth noticing.

10. Syrphus geniculatus.

Syrphus geniculatus Macquart, Dipt. Exot., II, 2, p. 101, 24.

"Thorace obscure æneo, nitido; scutello flavido. Abdomine lineari nigro, fasciis tribus flavis, interruptis. Antennis pedibusque nigris; geniculis anticis flavis.

"Long. $3\frac{1}{3}$ lines; male. (7.5 mm.)

Translation. "Face and front black, with blue and green reflections and gray pollen; face with a glabrous, very salient prominence.

Front with black pile. Antennæ black. Thorax with black pile; pleuræ with a slight gray pollen; scutellum yellowish, with yellow pile. Abdomen of an almost opaque black, with black pile on the sides, yellow at the base; second, third and fourth segments with interrupted yellow crossbands near the anterior margin, forming oval, transverse spots, bearing yellow pile on the sides; those of the second segment are oblique and smaller; fourth segment with a narrow yellow hind border; venter colored like the dorsum. Legs black, anterior knees fulvous. Wings grayish; stigma (cellule mediastine?) yellowish.

"Hab. Newfoundland. (Mr. Léguillon.) Type in the Museum."

"This species represents in America the *S. umbellatarum* Fab., Meig., which it resembles."

There are two conflicting species, to which this description of Macquart's may refer: one of these I take to be the true representative of *S. umbellatarum* of Europe; I have unfortunately no European specimens for comparison and assume the identity provisionally, upon comparison of Dr. Schiner's description; the other is probably Macquart's species. An objection, equally applicable to both species is, that Marquart describes the pile on the scutellum as yellow, while it is black; he may have meant a fringe of yellowish hairs which exists on the underside of the scutellum.

Syrphus umbellatarum (? Syn. Schiner, Fauna Austr. I, p. 307).

I will add a few details to complete Macquart's description, which is applicable, in the main, to both species.

Female. Eyes glabrous. Face yellow, with a whitish pollen almost concealing the ground color; in the middle, a brown stripe, crossing the facial prominence, but abruptly stopping before the base of the antennæ; this stripe does not run down on both sides along the oral margin (it does so for a short distance in a very few specimens); oral margin yellow, as well as the cheeks; front and vertex bluish green, (not brownish green); the yellowish gray pollen on the front forms a well-marked arch, sub-interrupted in the middle, leaving bare on one side, the vertex, on the other, a well defined triangle above the antennæ; the sides of this arch run down along the eyes and coalesce with the facial pollen; antennæ inserted on brownish yellow ground; thorax bluish green; scutellum dull yellow, brown at the extreme ends on each side; it seldom shows any trace of a bluish metallic reflection; the four front legs are reddish yellow, femora black at base; tibiæ with a trace of a brownish ring; tarsi brownish. The abdominal crossbands usually reach the lateral margins of the segments, but quite often they stop a little distance before, leaving a narrow black border between; their color is reddish, or pure yellow, with a more or less distinct whitish pollen, which often gives them a whitish appearance. Length, 8–9 mm.

Male. The face often, not always, has a more distinct metallic bluish reflection; the oral border is more often bordered with brown here than in the female; the ground color of the abdomen is more opaque.

I compared twenty-five males and sixty-five females, mostly taken by Mr. Morrison in the White Mountains, N. H.

S. geniculatus Macquart, l. c.[1]

Differs from my *S. umbellatarum* in being a little smaller (about 7.5 mm.); the face, in the profile, is much more projecting; the facial tubercle is metallic blackish green, which color extends on both sides along the oral border; in the other species the facial tubercle bears a distinct stripe; in the female the sides of the face, powdered with yellow pollen, have a brownish yellow ground color; in the male, the ground color seems to be blackish green throughout, although mostly concealed under a thick covering of brownish yellow pollen; the antennæ are inserted on black ground; the front, in the female, is brownish green (not bluish green), it is much broader than in the other species; the pollen on the front is much less thick; it follows on both sides the orbit of the eye to about half the distance between the ocelli and the antennæ, and does not reach as much towards the vertex as in the other species; it does not form a well defined arch; the glabrous space above the antennæ is smaller. The thorax is brownish green (not bluish green); the scutellum has a stronger bluish metallic reflection; the yellow markings on the abdomen are somewhat narrower, and paler yellow; in other respects they are exactly the same; the four anterior legs are of a darker reddish brown, sometimes almost black, with paler knees; when the legs are paler, the base of the femora does not appear abruptly tinged with black, as in the other species; hind legs black.

The easiest character for the distinction of the two species at first

[1] I became aware of the existence of this second species only after the beginning of the present paper had been already put in type; hence it is not mentioned in my introduction, where *S. umbellatarum* and *S. geniculatus* are treated as probable synonyms.

sight and in both sexes is the insertion of the antennæ on black, or on yellow ground. In *S. geniculatus* the dark color of the front reaches down to the very root of the antennæ; a very small brownish yellow space is only perceptible between the antennæ. In my *S. umbellatarum* the brownish yellow forms a little arch above the antennæ, which thus are inserted on yellow ground.

I have compared five females and two males, all taken in the White Mountains. The first specimens I received from Mr. Dimmock; later I found two females among sixty females of *S. umbellatarum*, collected by Mr. Morrison. This species thus seems to be rarer than the other.

My reason for referring Macquart's description (of the male) to this species, is his mention of the face being black, and of the four anterior legs being dark colored. This seems to me conclusive; the measurement he gives, also agrees bet.er with this species than with the other.

Notes on seventy-nine species of Birds observed in the neighborhood of Camp Harney, Oregon, compiled from the correspondence of Capt. Charles Bendire, 1st Cavalry U. S. A.

(The following notes have been taken, with his permission, from letters of Capt. Bendire, addressed to the writer. They were originally written without any reference to their publication, and do not attempt to give a complete catalogue of the birds of that region. The observations were made in the period between November 1874 and May 1875, in south-eastern Oregon, and embody new and interesting additions to our knowledge relative to a region hitherto unexplored. "Camp Harney is situated on the verge of a sage brush, or rather a desert, country at the base of the Blue Mountains. The country to the south of it, for two hundred and sixty miles, or until you reach the railroad, is fully as desolate, if not more so, than the worst part of Arizona. Numerous species of water-fowl are said to breed about Lakes Harney and Malheur, about twenty-five miles from the post." T. M. Brewer.)

1. Turdus migratorius Linn. "Feb. 23d, 1875. For the first time this season I heard the song of this thrush.—March 13th. The robins are now in full song."

2. Cinclus mexicanus Baird. "On the 18th of February, while up Rattle-snake Creek in search of deer, I shot the first specimen (a female) of this species I have seen about here. Length to end of tail, 6.75 in.; to end of claws, 7.05 in.; wing, 3.43 in.; tail, 2.10 in.; bill brown, paler towards the base of the lower mandible; feet and tarsi pinkish; iris light blue; contents of stomach, remains of black water beetles and larvæ of dragon-flies, also fine gravel."

3. **Sialia mexicana** Sw. This species is referred to, April 3d, as having just made its appearance for the first time. May 19th it is said to have entirely disappeared and its place taken by the *S. arctica*.

4. **Sialia arctica** Sw. This blue-bird is not referred to until May 19th, when Capt. Bendire writes: "This is the only blue-bird I see here now. *S. mexicana* has entirely disappeared. I found a nest of *arctica* on Monday in a hollow juniper tree. It had only a single egg and I left it."

5. **Regulus calendula** Licht. A single specimen was procured about Nov. 14th.

6. **Parus montanus** Gambel. Specimens were taken about Dec. 5th, and prior.

7. **Parus occidentalis** Baird. Specimens taken between Nov. 14th, and the 5th of December, 1874.

8. **Psaltriparus plumbeus** Baird. This species, taken November 14th, has not previously been known to occur in this region. "I have seen an old nest, pouch-like in shape, and about six inches long, fastened to a service-berry bush, undoubtedly built by a pair of this species."

9. **Sitta aculeata** Cassin. Specimens were taken between November 14th and December 5th, 1874.

10. **Sitta pygmæa** Vigors. Specimens taken prior to December 5th.

11. **Cistothorus palustris** Cab. "On the 18th of January, 1875, I shot a specimen of this wren (variety *paludicola*). I saw another at the same time. There are no swamps or rushes within fifteen miles of this place. They were hopping about the willows on the creek, searching for insects."

12. **Salpinctes obsoletus** Cab. "May 9th. The nest and eggs of the rock wren were found accidentally by two of my men, who were getting building-stone yesterday. In moving a flat rock lying on the side of a hill close to my quarters, they found a nest and four fresh eggs under it. Unfortunately a small bit of stone fell

into the nest and broke two of the eggs. The nest is not such a bulky affair as wrens' nests usually are, no doubt on account of want of room under the rock. It was about a foot and a half from the opening under the rock, on a steep hillside covered with boulders. The nest was composed externally of sticks and bark, and lined with fine rootlets and a little hair. The inner diameter of the nest was two and one-half inches, and the cavity not more than one inch deep. — May 19th. I find the Rock Wren rather common on looking closer for it; have seen more than a dozen in an afternoon's tramp, but not more than two in any one place. Their nests, however, can only be found by accident, they find so many nice places to hide them in."

13. Oreoscoptes montanus Baird. "May 29th. On the way to the lake I took a fine set of the mountain mocking-bird's eggs."

14. Myiadestes Townsendi Cab. "December 5th, 1874. Since I wrote you last (November 14th), I have seen a number of individuals of this species, and have taken several. In their habits they remind me very much of *Phainopepla nitens*. Like that species, they prefer to perch on dry limbs, and as high as they can get on the juniper trees, which they seem to frequent exclusively. At this season of the year they seem to feed on juniper berries entirely. I can bear witness to the excellence of their song. I find it very varied, soft and flute-like at times, strong and powerful at others, and it reminds me, in many respects, of that of the European sky-lark. I most certainly consider it fully equal, if not superior, to the song of our mocking-bird. Its usual call note is peculiar, and hard to describe. I took it down at the time of hearing it, and do not give it from memory. It comes as near as possible to the occasional sound produced by an axle of a wagon just about commencing to need greasing — like *hit-it*, and sometimes like *wa-ip*, with quite an interval between each syllable. Generally the bird is seen singly, rarely in flocks. It prefers isolated patches of juniper to the dense timber, and so I have only noticed it in junipers, or on rocks on the edges of bluffs.— May 19th. This bird does not breed about here. I have not seen one for a month."

15. Collurio excubitoroides Baird. This species is referred to as having first made its appearance a little prior to April 3d.

16. Carpodacus Cassini Baird. This species is referred to as having been taken between November 14th and December 5th, 1874.

17. Loxia americana Wilson. This species is first referred to as having been taken early in December. "February 18th. I shot a female of this species; a very small specimen, but an adult. As these birds were then still in flocks, flying around, and occasionally settling for a minute or two in the extreme tops of the tallest pines, it does not appear probable that they breed so very early in the season. I found its ovaries well developed, but in a normal condition."

18. Ægiothus linaria Cab. "December 5th. I have just obtained three specimens of this species.—January 24th. On the 20th I had an opportunity to observe quite a large flock. They allowed me to come within four feet of them. A number were hopping about the ground, while others were searching the alders through for insects. They seem to hang as easily on a small twig, head downward, as any other way, and are very active and quick in their movements, and also very quarrelsome. A number were constantly driving others from some favorite twig, and, scarcely settled there, commenced the same performance over again."

19. Chrysomitris pinus Bonap. A specimen is referred to as having been taken December 14th.

20. Leucosticte tephrocotis Sw. Mention is made, January 17th, of obtaining a single specimen of this species in the plumage of this form.

21. Leucosticte littoralis Baird. "Dec. 28th. On the 19th inst., I procured ten specimens of this species. They were feeding on a hillside, where the ground was covered in places with a little snow. The flock I shot them out of must have numbered about three hundred. It appeared to me that there must have been more than one species in this flock, but all of those I killed proved to belong to the same kind, but no two specimens were colored exactly alike. I killed them with two discharges, one while they were sitting on the ground, the other as they rose. The survivors flew three or four times over my head while I was picking up the dead birds, and kept up quite a twittering, as if they were calling for their lost companions, and finally left for the hills. They were very fat, and had their crops filled to such an extent that the skin of the neck was distended. They were filled with grass seeds and very minute green leaves of some wild plant that had just come above the ground during the few previous days of warm weather.

"January 24th. Yesterday evening, while at the company's stables, a beautiful male of this species alighted within three feet of me, and commenced picking up grass seeds scattered about on the ground. The wind was blowing a gale at the time, and it had apparently been lost from a flock, probably not very far off. Every few minutes it would utter the following call-note, *äetch äetch.* It was so unsuspicious, tame and confiding, that I had not the heart to molest it.

"February 12th. These birds appear to be fond of rocky hillsides, where the sun has exposed the ground a little; they seldom pass down into the valley, and if they do, their stay is short. They are very restless, alighting in one place only for a few seconds, and then flying off fifty or a hundred yards before coming down again. When flying in flocks they have a note somewhat resembling that of *Eremophila alpestris*, or *Plectrophanes lapponicus.* Their flight is undulating, at times somewhat resembling that of a woodpecker. It is almost strictly terrestrial. Indeed, as yet I have seen none alight on trees or bushes. Occasionally they settle on a roof for a few seconds before flying to the ground.

"February 26th. While returning from the mountains I shot a single specimen of this species. It was by itself, a fine male. The chestnut on its breast was not so bright and lustrous as in the winter specimens, but rather paler. On the 19th of March I procured two more specimens of this species. These are the first I have ever noticed sitting anywhere else than on the ground, or on rocks. They were perched in company with two others, on a willow bush, in close proximity to some red-shouldered blackbirds. In the spring and summer plumage of these birds the colors are not so bright as in winter, and the pinkish tints are paler, and nearly white. I notice a perceptible difference between these two specimens and those taken in December and January."

22. **Plectrophanes lapponicus** Selby. A specimen of this is mentioned as having been obtained December 14th.

23. **Junco oregonus** Sclat. Mention is made, in a letter dated November 14th, of procuring two specimens of this species. "February 23d. On this day I heard a lot of the Oregon snow-birds sing. They are not, by any means, bad singers. March 13th. This little bird is now in full song. May 19th. The Oregon snow-birds have all left, nor are there any on the mountains."

24. **Poospiza nevadensis** Ridgway. "March 11th. This is the first specimen of this species that I have seen about here. It probably winters farther south. Length 6.37 in.; wing 3.20 in.; tail 3 in. May 29th. On my way back from the lake I found a

nest of this bird with three eggs nearly hatched. The nest was on a sage bush, about a foot from the ground."

25. **Spizella monticola** Baird. Mention is made of specimens of this species having been taken between November 14th and December 5th.

26. **Spizella Breweri** Cassin. "May 29th. On my way to the lake I obtained three nests of Brewer's sparrow, containing four, three, and two eggs. The majority of the birds are building yet. These nests were constructed out of rotten fibres of wild flax, which grows abundantly about there, and are lined with fine grasses and a few hairs. The nests were placed in the forks of low sage bushes, about eighteen inches from the ground."

27. **Melospiza guttata** Baird. A single specimen shot November 14th.

"January 24th. Since I wrote you, on the 17th, I have procured several specimens of what I take to be this species. I have always found them singly, and they are by no means plenty.

"February 20th. I shot another specimen of this bird in the tall grass bordering the creek.

"May 29th. On my way to the lake I took a set of this Melospiza. It differs from the *M. fallax* in being much larger and darker, and has very different eggs, being much larger."

28. **Poœcetes gramineus** Baird. "On my way to the lake, May 27th, I took a nest of this species."

29. **Pipilo arcticus** Sw. "March 1st, 1875. While looking along the creek, I was astonished to see two specimens of this Pipilo. They were both males, and made their appearance much earlier than I expected. They actually came in the midst of a snow storm. Others were noticed between March 1st and April 3d."

30. **Eremophila alpestris** Boie. Mention is made, January 17th, of having procured a single specimen of this bird. "February 12th. Since the close of January I have shot several more specimens of this bird. They were all of them males."

31. **Agelaius phœniceus** Vieill. "On the 23d of February, a flock of these birds made their first appearance here."

32. **Agelaius gubernator** Bonap. "May 19th. This bird has begun to breed. I took two nests of it this week."

33. **Sturnella neglecta** Aud. The arrival of this bird is noted as having taken place prior to April 3d.

34. Scolecophagus cyanocephalus Sw. "May 19th. This species is now breeding. I have recently taken several nests."

35. Corvus carnivorus Bartram. The presence of the raven, in the vicinity of Camp Harney, throughout the winter, is occasionally referred to. Apr. 3d, Capt. Bendire writes: "I do not think that any of the ravens have commenced breeding yet, as I still see them in pairs about the garrison." In a letter dated April 18th, he writes that at Lake Malheur he "succeeded in obtaining two ravens' nests on the 16th, both with five eggs; one set quite fresh, the other probably not over four days sat on. They were hard to get at in each case, and I only succeeded, after several trials, in reaching them. One nest was built on a side of a cliff, about twenty feet from the ground, and thirty from the top. The other, in a large dead willow tree."

36. Corvus caurinus Baird. "March 9th. I saw three of this species feeding among the ravens. It was afterwards found breeding."

37. Picicorvus columbianus Bonap. "December 5th. My supposed whitish woodpecker, of which I wrote you in my last, turns out to be Clarke's crow. It is a consolation to me, however, to know that I am not the first one who has made this mistake. It is not to be wondered at that any one who has not seen them before, seeing them for the first time on the wing, should take them for woodpeckers. I am inclined to believe that this bird breeds here in hollow trees, and very early in the season. In an adult female that I shot the other day, some of the eggs in the ovaries were already considerably enlarged.

"December 14th. In the mountains I have found an old nest in the hollow of a pine stump, constructed of sticks and mud, which is a new structure to me, and I have but little doubt but that it is the nest of this species. It corresponds in size to what it should be.

"May 9th. I have at last found a nest, occupied this year, of Clarke's crows, and now know that in some instances they breed in hollow trees, and nest exceedingly early. I found a brood of six young ones well able to fly, on the 5th of this month. They must have left the nest about the 1st of May. The old ones almost flew in my face to attract my attention from the young, and kept up a terrible screeching. They must have commenced laying between the 15th and 25th of March, at least when the snow was over two feet deep in that locality.

"May 19th. I found another nest of Clarke's crow about ten or twelve days ago, with the young not quite ready to fly. It was on the top of a pine stump."

38. **Cyanura Stelleri** Sw. "On the 25th of February I obtained a female, the first I have seen here. They are said to be more plenty farther into the mountains."

39. **Sayornis Sayus** Baird. Referred to as present on, and a little prior to, April 3d.

40. **Tyrannus verticalis** Say. "Strange to say, the habits of this flycatcher are entirely different from what I found them to be about Fort Lapwai, Idaho, and also in Arizona. There I always found them about the streams, building their nests on cottonwood trees. Here, although they have the same opportunities, they are only found among the junipers and lone pines. I found one of the latter, in which at least five pairs of this species was building. The same tree also contained a nest of Swainson's buzzard, with eggs in it. These birds have only arrived within the past week. I have not noticed a single individual within the post, while in Idaho several pairs had nests within the officers' quarters, and I find them here three or four miles from water."

41. **Myiarchus mexicanus** Baird. "May 26th. Both yesterday and the day before I noticed a specimen of either *M. crinitus*, or of this species. There is no possible doubt about it at all. I know both birds very well, and recognized the birds at once by the crest and the chestnut underneath. I saw them each time among the junipers."

42. **Hylotomus pileatus** Baird. Mentioned as resident in the pine woods about Camp Harney.

43. **Colaptes mexicanus** Swain. Observed in the neighborhood of Camp Harney about April 3d. "May 27th. I have taken several sets within the past two days. The number of eggs in their nest was from six to nine."

44. **Melanerpes torquatus**. "May 27th. Several sets of eggs of this species, taken since the 20th, number from six to nine each."

45. **Picus albolarvatus**. "May 27th. I noticed one of this species excavating a hole in a dead pine tree some twelve days since, and concluded to try the tree yesterday. The hole was dug about half way up the tree, twenty-five feet from the ground. At the entrance it was about two inches wide, and entered the tree about three inches before turning down. It was about eighteen inches deep, the

bottom covered with small chips, on which I found two eggs. These resemble the eggs of other woodpeckers in color, a clear white, but the white is a dull opaque, and not so polished as those of *C. mexicanus*. One end of the egg is considerably larger than the other. They measure, one 1.02 in. by .75 in., the other 1.02 in. by .73 in."

46. Brachyotus Cassini Brewer. "March 5th. This species was met with for the first time to-day. I saw more here during the winter."

47. Syrnium ——? "On the 26th of February I examined a dead pine stump, in which a pair of owls are building their nest. I did not succeed in seeing them, but by the description given to me by the wood-chopper, who told me of them, I am inclined to think they are of this species. They are too small for *S. cinereum*, though I have not the least doubt that the latter breeds here also."

48. Nyctale acadica Bon. "On the 20th of January, I obtained a fine adult female specimen of this species alive. One of my men had caught it sitting on a low bush, about twenty feet behind the company's quarters. I had a cage made for it, hoping to be able to keep it alive, for the purpose of watching its habits. It killed itself, however, during the first night, by flying violently against the sides of its cage. Its iris was a bright lemon-yellow. It appeared to be darker and more spotted below than those described, the breast being uniformly marked with large, rusty, fulvous blotches. This color predominates throughout, over the white of the under parts; upper tail coverts like the back, lower ones immaculate white. The tibiæ and tarsi are of a delicate and uniform fawn-color, not spotted, this tint becoming paler, almost white, near the toes. My men tell me that a small owl resembling this one is common during the summer about the basaltic cliffs in the neighborhood. On the 25th of January, one of my men caught another specimen of this bird alive; this time a male. He saw it flying out from the willows on the creek running through the garrison, and alighting on a projection of a chimney at the quarters. He walked right up to the bird and caught it in his hands. It was in good condition, and its stomach contained the remains of a small bird hardly digested. This one is still darker about the lower parts than the other one. I put it in the cage also, and found it likewise dead the next morning. I cannot account for it. This one certainly did not die of hunger. It is considerably smaller than the female, and colored differently."

49. Nyctea nivea Gray. "January 25th. One of this species was seen to-day on one of the cliffs back of the garrison. Sergt. Smith was attracted to it by some ravens which were after the owl. He could not get near enough to shoot it. The ravens chased it out of sight."

50. Glaucidium californicum. "December 14th. This is the first of this species that I have ever seen. It is a female, and very dark colored, the lower part of the breast and abdomen streaked with pure black. In fact, the black predominates, and, judging from the description in the History of North American Birds, I would call this one considerably darker than any of the specimens Mr. Ridgway described. On examination of the ovaries with a lens magnifying about six times, I counted two hundred and thirty undeveloped eggs, which would justify the conclusion that these birds live to a good old age. It was exceedingly fat. Sergt. Smith shot it to-day, while he was out hunting on the mountains north of the camp. He caught it in the act of trying to get away with a large sized wood-mouse, or gopher. The mouse was on the end of a pine log, when the little owl suddenly dropped down on it, out of a pine tree standing close to the log, in which it had been sitting, about twenty feet from the ground, and fastened its claws in its back. The mouse ran nearly the length of the log, about twenty-five feet, carrying the owl on its back, the latter appearing perfectly unconscious about where the mouse was going with her, keeping her head turned in the opposite direction. The time occupied in getting to the other end of the log took nearly two minutes, when he shot them both. When killed, the owl had but a few hairs and small bones in its stomach. During the winter it must live on mice and small birds, and get plenty of both, as the condition of this specimen fully attested. The unconcerned, business-like manner in which the owl allowed itself to be carried by the mouse till the latter should be pretty well exhausted, before killing it outright, shows that this was by no means the first it had caught. That it is not strictly nocturnal, is shown by the fact that it was shot about noon."

51. Athene cunicularia Bon. "I saw one of this species on the 13th of March, but did not secure it."

52. Falco anatum Bon. "I saw a specimen on the 11th of March, but could not procure it."

53. Tinunculus sparverius Vieill. "May 26th. Yesterday I commenced war on the sparrow-hawks, and took no less than thirty of their eggs. I had previously taken memoranda as to where I had generally noticed them, and I obtained them all in little more than two hours. I am greatly surprised at the extreme variations in their eggs, both in size and color. I have them from nearly a pure white to the color of the eggs of *Lagopus albus*. Their eggs are five in number. Excepting one taken in a hollow pine stump, with the entrance on the top, they were all in old woodpecker's holes."

54. Astur atricapillus Bon. "May 26th. I took a nest of this species, but was a little too late. It contained two young ones and one egg out of which the young had already broken a piece."

55. Buteo calurus Cassin. "May 26th. I have just found a nest of this species, the first one I have seen here. Both this one and that of *Astur atricapillus*, were in the pine timber on the mountains."

56. Buteo Swainsoni Bon. Mention is made of having found quite a number of sets of eggs of this species. It appears to have been found quite common.

57. Circus hudsonius Vieill. "February 15th. To-day I saw the first specimen of this species."

58. Archibuteo lagopus Gray. "December 5th. Excepting this species, I find hawks very rare, and so shy that it is impossible to get near them.— December 14th. I have just obtained two specimens of this species, both males, and in light plumage. On the 18th of February, I also obtained a fine male. Of the four specimens so far taken, all have been males.— March 6th. I obtained a very fine dark male in the plumage of *Sancti-Johannis*."

59. Aquila canadensis Cassin. This species is said to breed in close proximity to Camp Harney.

60. Haliætus leucocephalus Savigny. This eagle is also said to be common, and to breed near the post. "February 16th. One of the men found a specimen of this species nearly starved to death."

61. Canace fuliginosus Ridgway. December 5th. Mention is made of finding this species and *C. Richardsoni* both common, and shooting a female of this species.—"December 28th. Our express messenger tells me he saw at least two hundred of this bird hopping about on the snow, close to the road — rather an unusual proceeding for this season of the year."

62. Canace Richardsoni Baird. "December 5th. A few days ago I shot four grouse, and find that we have two varieties here, *C. fuliginosus*, and certainly the present species, *C. Richardsoni.* Of the latter I procured a cock and two hens. They keep most of the time in the tops of the highest pines and spruces, only coming to the ground when the weather is pleasant. No shot gun can reach them, and the rifle destroys their value as specimens.— December 14th. I have just obtained a fine specimen of this species, a male of large size."

63. **Centrocercus urophasianus** Sw. "November 14th. A few days ago I saw a pack of at least seventy sage-fowl within half a mile of the post. I cannot agree with Mr. Ridgway in his statement that this bird rises with great effort, and that its flight is heavy and lumbering. Those I saw started up as quickly and as gracefully as either the sharp-tailed or the dusky grouse, and if it were not for the great difference in size one could not tell them apart while flying."

64. **Bonasa Sabini** Baird. "December 5th. I have just finished making a skin of what must be this species. It measures only fourteen and one-half inches in length. One of the sergeants shot it and brought it to me this evening. It is the first I have seen here, and they are said to be quite scarce. Its stomach contained the seed-vessels of the wild rose, willow buds and leaves of a plant resembling the water-cress."

65. **Ægialitis vociferus** Cassin. Mention is made, in his first visit to Lake Malheur, twenty-five miles south of Camp Harney, April 16th, of meeting with this species.

66. **Recurvirostra americana** Gm. This species was observed in the first visit to Lake Malheur.

67. **Gallinago Wilsoni** Bon. "On the 15th of February I obtained my first specimen of this bird — a female, but I have seen none since."

68. **Grus canadensis** Temm. Two eggs of a crane obtained near Camp Harney some time since, led Capt. Bendire to infer, from their size, that they might belong to *G. americanus.* In his letter of December 28th he writes: "From what I can learn, I think *G. americanus* does not occur about here, but that *G. canadensis* is very common and breeds here abundantly."

69. **Ardea herodias** Linn. "This heron was found breeding at Lake Malheur. Each nest contained four or five eggs. I brought a few sets along with me, and found a great deal of difference in both the color and size in eggs from the same nest."

70. Herodias californica Baird. "December 14th. About fifteen miles south of here I have found a large heronry, said to be of this species. There must be at least three hundred nests or more."

71. Botaurus lentiginosus Steph. Two individuals of this species were noted at Lake Malheur, April 16th.

72. Porzana jamaicensis Cassin. A single specimen of the black rail was noticed April 16th, near Lake Malheur.

73. Cygnus americanus Sharpless. "November 14th. I took the measurement of two swans yesterday, which one of the officers shot on Lake Harney a few days ago, where they are very numerous at present. Both I take to be of this species. One, an adult female, measured, length to the end of the tail, 52 inches; to the end of the feet, 55 in.; stretch of wings, 76 in.; tarsus to end of claws, 10.5 in.; bill, 4.5 in.; a pale orange spot in front of eyes; bill and feet entirely black; eyes blue. The stomach of this specimen contained about twenty small shells, perhaps half an inch in length — I have found large numbers of this same shell on the beach near Los Angeles, California — quite a quantity of gravel and a few black seeds. The smaller specimen measured as follows: length to end of tail, 50 inches; stretch of wings, 70 in.; a small patch of brown on the top of the head; no orange in front of the eyes; bill reddish except the tip and base; feet black; contents of the stomach nearly the same as in the other. This one is evidently an immature specimen. Both were exceedingly fat. I ate a piece of the younger, and found the meat very good, much better than that of the wild goose.

"April 18th. I saw, on the 16th, large flocks of swans, but all that were killed were of this species. There was not a single *buccinator* among them."

74. Bernicla canadensis Boie. "April 29th. I found at Lake Malheur several Canada geese breeding, with from four to six eggs in each nest. I have several of their eggs under a hen now."

75. Pelecanus erythrorhynchus Gm. April 16th and April 28th, visits were made to Lake Malheur. The following extracts are from letters dated April 18th and 29th: "I have just returned this evening from my first cruise in Malheur Lake, which has been sailed over for the first time. As an egg hunting expedition it has proved a perfect success. I obtained about a hundred eggs of the white pelican on one of the islands in the lake, the only one they use, apparently. I had no idea that these birds nested so early, as on the first of the month the lake was completely covered with ice, and I found some snow on this very island on the 16th, when I took the eggs. I add the measurements of nine specimens of the eggs, giving the extremes, namely, the largest, roundest, and smallest: 3.72 by 2.40 inches; 3.86 by 2.55 in.; 3.87 by 2.32 in.; 3.62 by 2.40 in.; 3.60 by 2.40 in.; 3.57 by 2.35 in.; 3.20 by 2.51 in. (this egg, in shape, resembles a large egg of the bald eagle); 3.17 by 2.23 in.; 3.20 by 2.21 in. The eggs were all fresh when taken, none had been laid more than four days, which would make the 12th of April their first deposition. All the nests were made to contain certainly two eggs, if not more; but about one-half as yet contained only a single egg. Several of the party cooked some of them, but I do not believe they hanker after any more. We brought back five unblown ones, and have an old hen sitting on them.

"I returned from my second trip to Malheur Lake yesterday morning (28th). The occipital crest in the specimens procured is, at least at this season, *not yellow*, and none of the feathers on the breast show this color. The crests of five specimens I shot show scarcely any difference in tint from the balance of the body, excepting that the elongated feathers have more a soiled than a pure white appearance. I should, however, call none yellow.

"All the birds that I saw, both male and female, and whether on or off the nest, had 'centre-boards' on the bill, and the statement that the male alone has this singular appendage, according to my observations, is not correct. I had a number of opportunities to observe the birds when not over fifty yards from them, and a strong field glass to assist me besides. They appear very sensitive about having their nesting places disturbed. On my second visit I found they had all left the island on which I took my first eggs, and had buried in the sands the few we had left. They occupy an island now about half a mile from the first one, and when I visited it there must have been on it more than a thousand eggs. Many of the nests contained three and four eggs each, all evidently laid by the same bird. The majority of the nests, however, contained only two, and I believe that many do not lay more than two eggs at a sitting.

"These birds are by no means ungraceful in their movements and show a great deal of tact and good sense in their fishing expeditions. West of the island where they breed, is their favorite fishing ground.

Here is a large spring coming right out from the hills, having a gravelly bed. It is the only place on the lake where the water is sweet and palatable. The shore here swarms with a species of sucker about eighteen inches long, and red on the sides. I camped a night there, and this kept the birds away in the day-time. At sun-down they began to collect, first by tens, then by fifties, and in a short while there was a string of them one hundred and fifty yards long, at least, and from four to six deep. The leader, evidently much bolder than the rest, moved up several times to within thirty yards of our boat, followed by a few, but something about the look of the boat did not please them, and the larger portion moved back again, the main body keeping about a hundred yards in the rear. Finally they all came nearer, and the boat losing its terrors, they moved all round it. For so many birds they kept singularly quiet; an occasional grunt from one, resembling the word *doöe*, was about all I could hear. They appeared to divide themselves into parties of about thirty, who acted in concert, forming a semicircle, gradually closing in towards the shore and driving the fish with them, and as soon as they had them in the shallow water about one and one-half feet deep and less, they all went for them, and such a splashing I have seldom heard. I watched them for several hours, and often had them within fifteen feet of me. The fish they catch are all from twelve to eighteen inches in length, and the dexterity with which they handle them is surprising. Very few get away from them. Dead fish they do not care for, and will not touch. They are not quarrelsome, and I have seldom seen a more interesting sight than I did the night I watched these birds. The color of their bills varies a good deal, some being of a very dark orange-red color, others nearly straw-yellow. The centre-boards also vary in length, height, and general shape. The nest is a mere hollow scratched in the sand. Their nesting place was perfectly alive with fleas, and the aroma by no means a well flavored one."

May 27th the lake was again visited: "The pelicans are thicker than ever. I could have gathered a wagon load of their eggs on the island where I first found them, April 16th. Quite a number of the the eggs were quite fresh. Two of the largest measured 3.99 by 2.20 in., and 4.01 by 2.19 in. I find that the usual number of eggs laid by the pelican is two. I saw but few nests with three or four eggs this time. I also noticed a few birds without any centre-board, possibly one in fifteen. I think that all have it excepting birds only a year old. This ridge is not always firm and regular, but in some is quite rough. The majority of the feathers of the occipital crest in a specimen now before me, are 3.50 in. long, and a few 4 in. These feathers are pure white. I can find no 'dusky patch' on this specimen. The feet are black. One of the eggs set under a hen hatched out in twenty-nine days. The young bird lived only a few hours.''

76. Graculus clilophus? Gray. In the first visit to Lake Malheur, what was taken to be a large heronry was observed. It was afterwards ascertained to be the breeding place of a species of Graculus. Most of the nests were on the ground, about a third only being on bushes not over three feet high, the balance on rubbish, or sticks, not more than six inches from the ground. On the 26th Capt. Bendire found them occupied with cormorants. The nests contained five eggs each. In a third visit to the lake other colonies of the cormorants were met with.

" The young of this species (judged from their size to be about two weeks old), are still perfectly devoid of down or feathers; the skin is a deep glossy black, and altogether they present a curious appearance. The eggs, four or five in number, are of an elongated oval shape, pale green in color, covered partly by a chalky matter. Their average size is about 2.42 by 1.48 inches; some specimens measure more both ways. One set of four measure 2 86 by 1.60 in.; 2.70 by 1.65 in.; 2.66 by 1.64 in.; and 2.70 by 1.60 in. The nest is composed of coarse sticks, and is about one and one-fourth feet in diameter, is shallow and lined with a few strips of bark and pieces of *tulé*, is raised a few inches from the ground and placed generally very close to the water. In one instance I found it occupying the nest of *Ardea herodias*, which was placed on a grease-wood bush about three and one-half feet from the ground."

77. Larus occidentalis Aud.

78. Chroicocephalus Philadelphia Lawr.

79. Sterna Forsteri Nuttall.

Capt. Bendire, in his visit to Lake Malheur, found these birds present about the islands in large numbers, and apparently preparing to remain and breed.

List of Birds observed at Grand River Agency, Dakota Ter., from October 7th, 1872, to June 7th, 1873. By W. J. Hoffman, M.D., late Act. Asst. Surgeon, U. S. Army.

My observations extend over a period of only eight months, and the list is therefore incomplete. At the time of my arrival at the Agency, in October, many species had already gone southward, and others were just beginning to appear when I was ordered farther north, to join the Yellowstone Expedition. Many other species might undoubtedly have been noted, but for the danger of meeting with hostile Sioux, in venturing too far away from the settlement.

Grand River Agency (and Military Post) is situated about midway between Fort Rice and Fort Sully, the distance to either place being about eighty miles, by land. Situated upon the western bank of the Missouri River, and half a mile above the mouth of Oak Creek, it is consequently on one of the mud flats, or river bottoms. Opposite the Agency there is also an island, covered with an undergrowth of willows and cottonwoods. The eastern banks of the river are destitute of vegetation on account of the barren bluffs, and it is only upon the western side that we find a variety of trees and shrubs. Here we find the cottonwood (*Populus monilifera*), several varieties of *Salix*, the bullberry (*Shepherdia argentea*), wild plum (*Prunus virginianus*), grape and *Clematis*, forming a dense undergrowth of vegetation, and a safe retreat for many of the feathered tribe. As the prairie is nearly destitute of shrubbery few birds are found away from the bottom lands, excepting the raptores.

Mr. J. A. Allen, in his "Notes on the Natural History of portions of Montana and Dakota," p. 15–16, mentions quite a number of birds as common at Fort Rice which I did not meet with at Grand River up to June 7th. His observations at the former locality were made from the 10th to the 20th of June, and I am inclined to believe that several of these species made their appearance there during the second week of June. I also saw quite a number of species procured and preserved at Fort Rice, which I failed to notice at Grand River two weeks before.

Oak Creek is so called from the great numbers of oak trees growing along its banks as far as ten miles inland. Few nests were found during my stay, and the scarcity no doubt depends upon the rascality of the young Sioux. These boys can be found at nearly all hours of the day, scouring the underbrush in all directions in search of eggs and birds. They are always armed with blunt arrows and bows, and know, too, how to use them very effectually.

In the following list I have added notes respecting each species, stating whether common or abundant or rare, as will be seen upon reference.

1. **Turdus migratorius** Linn. Robin.

Rather scarce. But one pair was found breeding in the vicinity of the Agency.

2. **Turdus Pallassi** Cab. Hermit Thrush.

Saw very few specimens. Obtained but two skins.

3. **Turdus fuscescens** Stephens. Wilson's Thrush.

Several pairs were observed near the hospital for several days, and finally disappeared. I saw the species again at Fort Rice.

4. **Galeoscoptes carolinensis** Cab. Cat Bird.

Common; and is found amongst the thickets nearly everywhere.

5. **Harporhynchus rufus** (Linn.) Cab. Brown Thrush.

Not as abundant as the last species. Found two pairs breeding on the island, opposite the Post.

6. **Sialia arctica** Sw. Rocky Mountain Bluebird.

Not very common. Saw several pairs near the truck garden, in May.

7. **Polioptila cœrulea** (Linn.) Scl. Blue-gray Gnat-catcher.

Very rare; procured but one specimen.

8. **Parus atricapillus** var. **septentrionalis** (Harris) Allen.

The only specimens I found were moving up the timbered bottom along Oak Creek.

9. **Sitta carolinensis** var. **aculeata** Allen. Slender-billed Nuthatch.

The only specimen I saw was a mutilated skin obtained near the head waters of Grand River, by a young Indian, and by him worn as an ornament in a raccoon-skin cap.

10. **Troglodytes aëdon** var. **Parkmanii** (Aud.) Coues. Western House Wren.

Rather common.

11. **Anthus ludovicianus** (Gm.) Licht. Titlark.

Found migrating southward late in September, and very abundant.

12. **Neocorys Spraguei** Scl. Missouri Sky Lark.

Saw no specimens near the Post, but was informed that they bred at the head waters of Oak Creek. This species prefers marshy soil, or where the grass is longer and denser than it usually occurs on the prairies.

13. Mniotilta varia Vieill. Black-and-white Creeper.

Saw several specimens at Oak Creek, and on the island, on June 2d.

14. Helminthophaga ruficapilla (Wils.) Bd. Nashville Warbler.

Quite common in the bottoms, where well timbered.

15. Dendrœca æstiva Baird. Yellow Warbler.

Common along the river.

16. Geothlypis trichas Cab. Maryland Yellow throat.

Rather common; appeared to be migrating northward when observed.

17. Petrochelidon lunifrons (Say) Cab. Cliff Swallow.

One small colony built their nest under a bridge crossing Oak Creek, half a mile southwest of the Agency. No eggs could be obtained at my time of departure — June 7th.

18. Vireo olivaceus Vieill. Red-eyed Vireo.

Saw several specimens, but received only one.

19. Collurio sp.

Saw but one specimen of this genus, and could not get near that. Had no gun at the moment.

20. Chrysomitris tristis Bon. Yellow Bird.

Saw but few specimens, and they remained near the Agency for only one day.

21. Plectrophanes ornatus Towns. Chestnut-collared Bunting.

Apparently very rare. Saw but four specimens. Oak Creek.

22. Plectrophanes Maccowni Bd. McCown's Bunting.

Found less frequently than the preceding species; but generally associating with it when found.

23. Junco hyemalis var. **Aikeni** (L.) Ridgw.

Procured several specimens late in October; associates with the following species.

24. Junco cinereus var. **caniceps** (Wood.) Coues. Gray-headed Snowbird.

This species was also common until the approach of the extremely cold weather (in November), when the thermometer usually stood below zero.

25. Spizella socialis Bon. Chipping Sparrow.

Rather common among all the thickets.

26. Spizella pallida Bon. Clay-colored Sparrow.

Common. Found breeding.

27. Chondestes grammaca Bon. Lark Finch.

Not as common as the two preceding species. Found farther away from the Agency.

28. Molothrus pecoris Swain. Cow Bird.

Not of frequent occurrence. Several pairs found associating with a flock of *Xanthocephalus icterocephalus* in the vicinity of the corral and stables; also found miles north of the Agency, at the herders' camp and corral. Found it again on Rose Bud Creek, west of Fort Rice, where I also found an egg, in nest of *Calamospiza bicolor.*

29. Agelæus phœniceus Vieill. Red-winged Blackbird.

Very rarely seen.

30. Xanthocephalus icterocephalus Baird. Yellow-headed Blackbird.

Very common. Immediately after their appearance at the Agency and vicinity, I collected quite a number of skins of males, of which some had the yellow of dark orange, and others nearly a cream white (except the head).

31. Sturnella ludoviciana var. **neglecta** All. Meadow Lark.

Common. Found several times in the surrounding prairie, but I think accidental. The note of this variety is exactly similar to that of the same species, as it occurs in Nevada.

32. Icterus spurius Bon. Orchard Oriole.

Scarce. Saw but two pairs.

33. Icterus Baltimore Daud. Baltimore Oriole.

Occasionally observed amongst the willows and cottonwoods on the island.

34. Icterus Bullockii Bon. Bullock's Oriole.

Rather common all along the timbered river bottoms. (Rare above Fort Pierre, *Hayden*). More or less frequent all along the river, to Fort Rice, Heart River, Yellowstone River, etc., see also Allen "Nat. Hist. Montana and Dakota (Yellowstone Expedition), 1873."

35. Quiscalus purpureus Licht. Crow Blackbird.

Frequently seen, though rare.

36. Corvus corax Linn. Raven.

Not often seen in this vicinity.

37. Corvus americanus Aud. Common Crow.

Rather common.

38. **Pica melanoleuca** var. **hudsonica** All. Magpie.

Saw none near the Agency. Occur occasionally on the Buttes, two miles northward, and eight miles up Oak Creek.

39. **Tyrannus carolinensis** Bd. Bee Martin.

Saw but few on the island.

40. **Tyrannus verticalis** Say. Arkansas Flycatcher.

Not common. Shot but two near Oak Creek.

41. **Sayornis sayus** Bd. Say's Flycatcher.

Saw but few. These birds no doubt appear later in the spring than other summer birds.

42. **Ceryle alcyon** Boie. Kingfisher.

Saw several specimens, but always on the wing.

43. **Picus pubescens** var. **Gairdneri** Coues. Downy Woodpecker.

Occasionally found in the groves of oak trees along Oak Creek.

44. **Melanerpes erythrocephalus** Swain. Red-headed Woodpecker.

Rather common in the timbered portions of the valleys.

45. **Colaptes auratus** Sw. Golden-winged Woodpecker.

Occasionally seen, though difficult to approach.

46. **Bubo virginianus** Bon. Great Horned Owl.

Rather rare.

47. **Brachyotus palustris** Bon. Short-eared Owl.

Occasionally found on Oak Creek.

48. **Syrnium nebulosum** Gray. Barred Owl.

Met with occasionally in the timbered bottoms along Oak Creek, and on the island.

49. **Nyctea scandiaca** (Linn.) Newt. Snowy Owl.

Seen but twice. The Indians report it as not uncommon.

50. **Speotyto cunicularia** var. **hypogæa** Coues. Burrowing Owl.

Abundant eight miles north of the Agency, at the prairie dog towns.

51. **Falco sparverius** Linn. Sparrow Hawk.

Common farther away from the Agency.

52. **Buteo borealis** Vieill. Red-tailed Hawk.

Only occasionally seen.

53. **Buteo Swainsoni** Bon. Swainson's Hawk.

Shot but two specimens, which I take to be mates.

54. Archibuteo ferrugineus Gray. Western Rough-legged Hawk.

Not seen near the Agency. Indians procured specimens on Oak Creek, ten miles inland.

55. Pandion haliaëtus (Linn.) Cuv. Fish Hawk.

Saw this species along the Missouri River at various times during autumn and spring. Found no nests.

56. Aquila chrysaëtos Linn. Golden Eagle.

The only specimens seen were brought to the Agency from the head waters of Grand River, near the Black Hills.

57. Haliaëtus leucocephalus Savig. Bald Eagle.

Saw several in May. The Indians frequently shot specimens along the Missouri, between Grand River and Standing Rock (forty miles farther north), also at the head waters of Grand River. The feathers are highly prized by the natives for a variety of purposes, chiefly in head decorations.

58. Cathartes aura (Linn.) Ill. Turkey Buzzard.

Of frequent occurrence at the Agency Corral, ten miles south of the settlement.

59. Zenædura carolinensis Bon. Carolina Dove.

Very common.

60. Ectopistes migratoria (Linn.) Sw. Wild Pigeon.

Saw but one small flock throughout my whole stay at the Post. One male bird was procured.

61. Centrocercus urophasianus Sw. Sage Cock.

Not often found near the Agency, though considerable numbers are brought in by the Indians, who shoot them on the plains, where artemisia occurs.

62. Cupidonia cupido Bd. Prairie Hen.

Rather abundant; and during the extremely cold weather has been ound near the stables and corral.

63. Ægialitis vociferus Bp. Killdeer Plover.

Rather common.

64. Recurvirostra americana Gm. Avocet.

Saw several specimens in June. Reported as common in some localities.

65. Gallinago Wilsoni Bp. Wilson's Snipe.

Never saw any specimens near Grand River, although it occurs at Cheyenne River, and near Fort Rice.

66. Tringa minutilla Vieill. Least Sandpiper.

Rather common along the water courses.

67. Numenius longirostris Wils. Long-billed Curlew.

Occasionally found along Oak Creek, in the vicinity of grassy and moist soil, although no nest has been found, neither do the Indians know of its breeding here.

68. Ardea herodias Linn. Great Blue Heron.

Occasional flocks observed migrating in May. The Indians obtained several specimens. The tarsi are highly prized for making riding-whip handles.

69. Nyctiardea grisea var. **nævia** Allen. American Night Heron.

Not resident, and of seldom occurrence.

70. Grus canadensis Temm. Sandhill Crane.

Migrant. The Indians sometimes secure specimens; they use the skins for making ornamental pouches.

71. Fulica americana Gm. Mud Hen.

Common along the banks of the Missouri River.

72. Cygnus buccinator Rich. Trumpeter Swan.

Saw skins only. The Indians sometimes preserve these for ornamenting various articles. This species occurs occasionally on the small inland lakes, formed in early spring by the melting snow.

73. Cygnus americanus Sharp. American Swan.

Rare, though more frequent than the preceding species.

74. Anser hyperboreus Pall. Snow Goose.

Great numbers passed northward during the middle of April. Stragglers are occasionally found on the Missouri River, or on some of the smaller tributaries.

75. Branta canadensis Gray. Wild Goose.

Numerous during April. They are reported as breeding on many of the inland lakes north and northeast of this settlement. Young birds have also been found at the head-waters of Oak Creek.

76. Anas boschas Linn. Mallard.

Migrant.

77. Spatula clypeata (Linn.) Boie. Shoveller.

Migrant; sometimes found during the summer.

78. Bucephala albeola Bd. Dipper.

Saw several specimens ten miles below the Agency; one or two were shot from the steamboat.

79. Pelecanus trachyrhynchus Lath. White Pelican.

Said to occur frequently. Saw quite a number of skulls in various Indian tents.

Notes on the Cause and Geological Value of Variation in Rainfall. By Prof. N. S. Shaler.

The rainfall of the earth's surface is the most variable of all its conditions. Great as are the variations of temperature, they are relatively less considerable than the variation in the amount of moisture deposited. In the range from less than ten to over eight hundred inches, which can be found in one region within a few hundred miles, and in the considerable, though less striking, variation at many points on the earth's surface, we have a rate of difference many times greater than that which occurs in the range of temperature between the equator and the poles. There are two kinds of variation, both of geological interest, but belonging to different categories of facts. The first of these classes includes the variation due to change in the distribution of the rainfall of the earth, the quantity of that rainfall being the same; the second class includes the variations which arise from the differences in the amount of the total evaporation. The existence of such variations may be regarded by some as a questionable matter; the evidence, however, is great in quantity, and of the most distinct kind, going to show that in the immediate past the rainfall of the earth's surface was greater than now. On every continent, save Europe and South America, we find closed basins, which show distinctly that there has been a gradual and progressive shrinkage of the waters within the time that has elapsed since the end of the glacial period. I do not mean to maintain that the shrinkage of a salt lake after its separation from the sea, is a necessary consequence of a diminution of the rainfall. There are, at the present time, many regions of the ocean where the supply from the clouds is not sufficient to balance the evaporation. Many parts of the Mediterranean, if closed by some barrier from the general ocean, would begin rapidly to shrink into the state and dimensions of the Dead Sea; but a lake separated from the ocean by a barrier, and shrinking from a gradual abstraction of its water through evaporation, the climate remaining the same, would probably retire slowly, and with a certain steadiness from the time of its formation until it found itself, so to say, balanced, the evaporation area just equaling the rainfall. But many, if not most, of these areas of excessive evaporations cut off from the general supply, show us a series of terraces which probably represent a succession of stages in the shrinkage when, for a time, a balance was attained. These terraces are said, among other cases, to be prominent on the basin of the Great Salt Lake.

Considering, for a moment, the case of this particular basin, we notice that the shrinkage is marked by terraces, said to be so distinct that I find it difficult to believe that they were formed before the glacial period. If we accept, then, the opinion that they were formed since the last ice time, we are driven to either of two conclusions: that the basin was below the sea at the close of the glacial period, or that it has had its water supply greatly diminished since that time. It is manifest that the basin could not have been lowered into the sea during, or since, the last glacial period; so, granting the shrinkage phenomena to be recent, we are driven to accept the conclusion that terrace levels are due to a recent diminution of rainfall. Much the same considerations will convince us that many other of the closed lake-basins of the earth represent a shrinkage of rainfall in their regions, a shrinkage going on to the present day. Evidences of diminished rainfall are not wanting in many regions which have not been made into closed basins. The western shore of South America seems to have felt the effect of this shrinkage since the period of man. There are in Peru, for instance, evidences of extensive cultivation in the shape of artificial terraces, where irrigation is impossible, and where no crops could be grown with the present rainfall. Similar and even stronger arguments could be drawn from the well known facts given by the Caspian Sea and its neighborhood.

Without endeavoring, at present, to assemble all the evidence which points to the diminution of rainfall, I propose now to consider what are the forces which could bring about a change in the amount of rainfall in any country. There are evidently two ways in which the rainfall of a country may be modified: 1st, by the change in the distribution of the total rainfall of the earth; 2d, by the change in the actual amount of that rainfall through the reduction or increase of evaporation. It is evident that these two sets of causes may, and doubtless do, coöperate and interact to a greater or less extent, but this is a matter I do not intend to discuss.

Considering the first of these categories of causes, we see abundant evidence to show us that in the successive changes of level of the land, bringing every point of its surface at various times at different heights, we must have a most efficient cause of variation of rainfall. It may be safely said that a change of level of one hundred feet in any country would be necessarily attended by a perceptible variation in its rainfall, while by a change of five hundred feet the effects might be of great importance in the distribution of animals and plants. The change of the height of other regions may have as important an influence as the elevation or depression of the given district. In fact, the interaction of these causes leads to very complicated phenomena, which it is far beyond my purpose to consider. It is evident that they may be grouped together under the general term of the influence of height. This is probably by far the greatest determining influence of a local kind.

Along with this cause comes the position of areas of evaporation; the height and conditions of a country being unaltered in every regard, a variation in the evaporation region which supplies it may have a great effect upon its rainfall. If a considerable part of the evaporation areas supplying North America became dry land, the effect must be great without any coöperating action occurring on the continent itself.

Change in the direction or force of ocean currents would also have great effects. When the Japan current entered the Arctic Ocean, giving that region the warmth it had when its vegetation resembled that existing in the Mississippi Valley at the present time, there probably was a material increase of the rainfall there, and probably a diminution of the deposition in the tropical region, caused by the considerable lowering of heat in that region, while a large part of its temperature was being dissipated in the Arctic Ocean. These considerations seem to confirm us in our belief in the very great variability of the conditions which affect the distribution of the rainfall, assuming it to remain constant over the world at large. Enough has been written concerning the influence of forests, etc., to make it unnecessary to advert to these influences in this paper.

Turning now to the conditions which may affect the total amount of water lifted from the earth's surface during the year, we come to a class of questions which have been very little considered by meteorologists, and possibly with good reasons, since the main aim of the real advancers of that science is to keep out of the field of pure conjecture. It will, I trust, be evident, however, that something can be gained from a glance at this question without becoming too speculative in our considerations.

The most material influence which can come from the elevations and depressions of the land on the total rainfall, will, in the main, arise from the following causes: —

1. The narrowing or widening of the evaporation area.

2. The restrictions put upon the passage of marine currents by the form of the land.

I am inclined to think that the first of these actions may have considerable value. For instance, if the lands of the tropical regions have been steadily increasing in area ever since an early geological period, a proposition which could find a good deal of support, then the total evaporation area and the consequent rainfall must have been diminishing. Even supposing the Lyellian hypothesis to be true, and the amount of land and water to remain the same, the total evaporation would be greatly effected by changes which should accumulate the water area about the poles, or about the equator.

The effects of the obstruction of oceanic currents are not less important than those just suggested. If, by any cause, as, for instance, from the barring of the currents in their northward course, as the Japan current is now barred, only on a more extensive scale, the oceanic streams were kept more within the equatorial belt than at present, the result would probably be a slight diminution of the total amount of rainfall.

These causes, though greatly affecting the distribution of rain, must on the whole, have comparatively little effect upon the aggregate rainfall. I am inclined to think that the main cause must be sought in the alterations in the heat which comes to the earth from the sun. Although some importance has been attached to the accession of heat from extensive and prolonged volcanic eruption, it does not appear that this can be a great cause, for Mayer's computation shows that, at present, the quantity of heat received from the earth's interior cannot amount to more than one sixtieth of the total heat that comes to its surface. But the variation in the supply from the sun is a possible cause that has been but little considered. The fact that the limited time that has elapsed since star maps have been made has shown us very many variable stars of exceedingly different periods of variation, some passing regularly through a cycle of change, and some varying in what seems to be a paroxysmal manner, may well make us question whether it is not in the nature of stars to be variable, and whether this variability does not belong to our sun as well. It should be noticed that slight variations are probably more likely to occur than great changes, and that to bring about great alterations in the earth's conditions, we need only changes which would not materially alter the brilliancy of our sun, as seen from the distance at which we behold the fixed stars. The heat of the sun could be increased by twenty-five per cent. without materially changing the magnitude of the sun as a star.

In a previous communication to this Society,[1] I have called attention to this cause as a possible source of the climatic changes of the glacial period, the invasion of ice being brought about by the sudden increase of the precipitation of water in high latitudes, due to an increase of heat and a consequent increase of rainfall. If we take this view of the cause of the glacial conditions, then the existence of evidence of the diminution of rainfall during the time since the close of the glacial period, becomes a matter of the greatest interest. While the whole question is involved in the greatest doubt, as I have tried to show in the first part of these notes, I am inclined to think that there is some evidence to be drawn from the physical record left in our salt lake basins to indicate the great probability of a diminution of rainfall since the last ice time.

Besides this physical evidence of the change in rainfall, the palæontological record supplies us with some evidence of a valuable kind, looking in the same direction. Whenever we trace back the history of any of our land mammals, we generally find the variety of representative species which was in existence during, or just at the close of the glacial period, showing by its size or by its distribution that the conditions of environment were those which gave a very abundant supply of food. These conditions could not have been those brought about by greater mean annual cold, but must have been the result of climatic conditions, such as would be caused by greater rainfall, and less range of temperature between winter and summer. As I propose to extend these considerations in a special paper on the subject, I will not cite the instances which support this opinion.

In various discussions of this subject, I have attributed the great transportation of water from the equatorial to the polar regions, assumed to have occurred during that period, to the increased difference of temperature between these regions during, at least, the first stages of a glacial period, and the consequent increase in the activity of the trade winds; it being assumed that, owing to the formation of a cloud-wrap about each pole, the equator would gain more in heat from an increase in the heat of the sun, than the circumpolar regions.

[1] See Memoirs of the Boston Society of Natural History, Vol. II, Pt. III, No. 3.

The winter of 1874–75 having been unusually severe throughout the northern part of the northern hemisphere, it seemed likely that we should, if the foregoing hypothesis were true, find some trace of the effects arising from this temporary increase of the difference between the polar and equatorial conditions, corresponding to that greater change which was assumed to have taken place during the glacial time. In a word, if the average of rainfall is the result of the trade and counter-trade winds, and their products the sea currents, and if these winds are measured in their force by the difference of temperature between the equatorial and polar districts, then the period of very low temperature which, in the winter of 1874–5, prevailed throughout the northern hemisphere, should have brought a season of great rainfall in its train. Allowing six months for the completion of the trade wind circuit, we would expect the return of this rush of counter-trades, with their load of water, in the midsummer of 1875. It may have been only a coincidence, but it is a noteworthy fact that this season was one of the rainiest ever known in the northern hemisphere. It will at least make it desirable to compare the winter and summer temperatures and the rainfall over a considerable time. Following this same line of conjecture one step farther, I may notice that the annual rainfall during the winter seasons immediately preceding the extremely cold season of 1874–5 had been much less than usual. This gives a basis for the hypothesis that one of the cycles of change in climate may be something like this: a progressive diminution of rainfall in the circumpolar region, a consequent decrease of the cloud envelop of that region, and increased loss of heat by radiation leading to an intensification of cold, and that in turn bringing about an increase in trade winds and consequent greater rainfall. This rainfall will bring up the polar temperature, diminish the difference in heat between that region and the equatorial belt, whence the trade winds will slacken, and the circumpolar rainfall again diminish, bringing again increase of radiation and lowering of temperature.

This is, I acknowledge, highly conjectural, but in the present state of the question of climate, while too much value must not be given to conjecture, it may yet have some value. As regards the geological effect of rainfall, there is one point of considerable importance to which attention has not yet been directed. I refer to the great difference in the rate of wearing at different points, due to the action o the different rates of rainfall. In our own country, for instance, the region west of the Mississippi is, as a whole, wearing at only about one half the rate of the region east of that belt. If this is continued for only ten millions years, the effect will be to make a great difference of the height of the two regions.

Mr. S. H. Scudder exhibited a series of post-pliocene fossils from the bluff at Sankoty Head, Nantucket, with samples of the sands in which they were found, and of the underlying gravels, sands and clays.

The sands and gravels rest at base upon a thick bed of light brown sandy clay of uncertain thickness, but extending upward to about twenty feet above the sea-level. As the beds which rest upon it dip to the southwest, and as the anchor brings up clay from Sankoty Head eastward for half a mile, this clay bed is probably of great thickness. Messrs. Desor and Cabot, who gave the first account of this deposit,[1] speak of it as "nearly twenty feet" in thickness, but as that, by their estimate of the height of the bluff and the strata of which it is composed, brings the bottom of the bed exactly to the level of the sea, they apparently do not intend to limit its lower level to that point. In my excavations I penetrated it for over seventeen feet; it was very compact and difficult to dig through, and varied only, and that irregularly, in the amount of sand intermixed with the clay.

This brown clay is overlaid by four feet of gravel and coarse sand, the coarser parts mostly confined to three or four inches of the uppermost levels; the upper bed is more or less ferruginous, and hardens on exposure into a rather compact conglomerate. To this stratum must doubtless be referred a single specimen of a bivalve (probably a Mactra), with valves half open, picked up on the bluff, imbedded in a lump of gravel conglomerate, and, like it, strongly oxydized. The gravel is followed by about four feet of sands, subdivisible into separate beds, viz.: at base, an inch or two of a very fine loose white sand; followed by nearly two feet and a half of a little less fine, closely packed, white sand, with irregular ferruginous streaks through its mass; this is covered by nine inches of a coarse beach sand, with a still coarser sand in pockets; and this again by nine inches of a very fine white sand. Above this comes a foot of ferruginous sand,

[1] See Quart. Journ. Geol. Soc. Lond., v, 340–44; also these Proceedings, III, 79–80; and the Memoirs of this Society, I, 252–3.

closely packed with masses of tough blue clay, much exceeding the sand in bulk, and forming the floor of the fossiliferous beds.

These consist first, at base, of twenty-two inches of coarse sand, in which the oyster, quahog, and common clam are the prevailing forms, the first predominating to such a degree as to make the name of oyster-bed the most appropriate. This merges into a serpula-bed, about twenty-eight inches in thickness, made up almost altogether of large masses of Serpula, packed in sand and almost wholly devoid of other fossils. The bed of worn shells superimposed on this is about twenty-two inches in thickness and closely resembles *coquina*, except in the entire want of adhesion between the fragments.

This bed is followed by about ten feet of fine, white, thinly bedded sand, and this by the stratified drift of the island, to a depth, as estimated by Desor and Cabot, of forty-two feet; the foot of peat mentioned by them is wanting at this exact locality (though present a few hundred feet farther south), leaving the drift covered by five or six feet of dune-sand, more or less intermixed beneath with loam.

On following the bed of broken shells along the face of the cliff, it was found to thin out to about a foot in thickness twenty-five feet on either side of the most prominent point, where the section was made, and which has doubtless been longer protected than the other parts of the bluff by the former presence of a great mass of clay next the water's edge, called "Antony's Nose"; beyond these twenty-five feet, the bed of broken shells becomes more or less obscured by an admixture of sand, gravel and serpula, and is entirely lost at forty feet distance on either side.

The general dip of the strata, from the lowermost clay to the bed of worn shells, is to the southwest. The uppermost beds incline along the face of the cliff three degrees to the south, while the inclination to the west (along the section dug out of the cliff) is eleven degrees, making a dip of nine degrees to the southwest. All the beds below this also incline eleven degrees to the west, but the inclination of their face toward the south increases gradually in passing downward, that of the upper edge of the lower clay reaching eleven degrees, and making the southwesterly dip of this bed seventeen degrees. There is no evidence of any thinning out of the gravel-bed, as stated by Desor and Cabot, nor of any unconformability between this bed and the underlying clays; but, on the contrary, every appearance that the latter belong to the same continuous series as the former.

It is worthy of note that the fossils of this locality lie above the clays, instead of in them, as in most of the New England localities of post-pliocene marine shells.

Prof. A. E. Verrill, of Yale College, has studied the fossils obtained by various parties from these strata, and comes to interesting conclusions, differing from those of Messrs. Desor and Cabot, which were based on much more meagre collections. The latter gentlemen enumerate but seventeen species, and state that they are common to the two beds, while Prof. Verrill finds sixty species, most of them Mollusca, of which only thirteen, or less than twenty-two per cent., are common to the two strata; thirty-seven species are found in the lower, and thirty-six in the upper bed. He also finds the fauna of the two beds very different in character, the condition of the shells in the lower bed, and their southern character, showing that they were deposited "in the very quiet waters of a sandy sheltered bay, entirely protected from the action of the oceanic waves"; he compares the assemblage of species to those "now living in the protected bays of southern New England, at the depth of from three to five fathoms." On the other hand, the abundance of northern forms in the upper bed of broken shells, shows that it "was deposited by the cold waters of the outer coast, and their water worn condition proves that the deposit was made in very shallow water near the shore, or near sand shoals swept by the waves."

All the species of both the beds still inhabit the waters of southern New England, excepting one, which has not yet been found further south than Massachusetts Bay. Prof. Verrill does not find any difference between any of these fossils and their recent representatives living in the same region, with the exception of the quahog (*Venus mercenaria*), the fossil specimens of which are usually very heavy; but as he has found considerable variation, both among fossil and living examples, he does not believe the distinctions noticed to be "anything more than a local variation, such as often occurs in many species at the present time." Yet he proposes for this form the varietal designation *antiqua*.

I have not had an opportunity of comparing the fossil quahog with any specimens coming from a depth of from three to five fathoms (at which he believes the beds containing these fossils to have been deposited), but last year I compared from twenty to thirty perfect fossils, with as many recent ordinary Nantucket specimens of the same size, taken from a heap of refuse, and noted between them the following differences, which seemed to be pretty constant throughout: the fossil shells are much heavier and thicker, especially near the margin, and at the back; the concentric sculpture is coarser, broader and more prominent; there is a less perceptible tendency toward the formation of two rounded ridges on the anterior end, passing from the beak toward the ventral region; the hinge-teeth are coarser, and separated by wider intervals; the lateral teeth are much stouter; the muscular impressions deeper; and notwithstanding the greater general coarseness of the shells, the beading along the inner edge of the margin is generally finer.

A letter was also read from Mr. William Denton, calling attention to an asphalt bed near Los Angeles, California.

The locality is known as Major Hancock's Brea Ranch, and is about eight miles west of Los Angeles, in the valley of the Santa Anna. The bed of asphaltum here covers sixty to eighty acres, and at a depth of thirty feet no bottom has been reached. Thousands of tons have been removed for roofing, paving and combustion, but the supply is almost inexhaustible.

Major Hancock had about twenty-five Chinamen employed in digging out the best of the asphaltum, which is soft enough to agglutinate in the heat of the sun. The material was conveyed to large, open iron boilers, in which it was boiled for twenty-four hours, and then run into sand moulds; subsequently it was broken up, for it is quite brittle after being thus boiled, carted for nine miles and shipped to San Francisco, where it was sold for twenty dollars a ton for making asphalt pavement. The bed is about three miles south of the Santa Monica range of mountains, and it appears to lie parallel with them.

Beds of petroleum shale of tertiary age, having in many places a thickness of about two thousand feet, are to be found along the California coast, and at some distance in the interior; they are said, by Prof. Whitney, to extend from Cape Mendocino to Los Angeles, a distance of about four hundred and fifty miles. They are exposed in cliffs on the coast near Santa Barbara and Carpinteria, and other places. This shale, there is good reason to believe, is the deposit from which all the asphaltum of California has been derived.

Although this shale is not exposed in the vicinity of the Brea Ranch, it is exposed in various localities at but a short distance, and doubtless underlies the asphaltum deposit, for hundreds of "tar springs" exist in the vicinity, from which the material is still flowing over the surrounding locality, the springs being in some cases elevated, by its deposition around them, several feet above the surrounding level.

Major Hancock presented me with what I found to be a canine tooth of a Machairodus, a great sabre-toothed feline. It was found at the depth of fifteen feet in the asphaltum. The tooth is nine and a half inches in length, measured along the curve, and the breadth of the crown at the base is an inch and three-quarters, being larger than any tooth of the European Machairodus, whose measurement I have been able to find. The crown of the tooth is broken, and its entire length could not have been less, I think, than eleven inches. The tooth from the Val d'Arno, in Italy, referred to by Falconer in his Palæontological memoirs, measures eight and one-half inches in length, and the breadth of the crown at the base is one and one-half inches, while the tooth found by McEnery in Kent's Hole, England, is six inches in length, and one and one-fifth inches in breadth. The Californian tooth is closely serrulated on both the concave and the convex sides. It seems to have been exposed to the action of the elements for a long time, and contains a number of fractures, some of which have been united by the asphaltum in which it was imbedded.

I obtained a number of teeth of the fossil horse, and bones of the deer, a large bovine animal, the otter, seal, albatross, and other animals. I found near the pit a portion of the right upper jaw of the fossil horse, containing four molar teeth, or three premolars and one true molar. The first premolar is smaller in proportion to the size of the other teeth than those of the recent horse, judging by several with which I have compared it, and smaller than those of the fossil horse of India. It is but one inch in length, and three-quarters of an inch in breadth; but the other three teeth are larger than the average of the recent horse. The Machairodus tooth, with several from the fossil horse, were exhibited.

Prof. N. S. Shaler presented for publication in the "Memoirs," a paper on the Geology of Martha's Vineyard.

October 20, 1875.

The President, Mr. T. T. Bouvé, in the chair. Thirty-one persons present.

Prof. Edw. S. Morse gave an account of farther investigations on the structure of the carpus and tarsus of birds, which he had studied in many species of marine birds at Grand Menan Island, during the past summer.

Mr. S. H. Scudder presented to the Society a supplementary note to his paper on the Fossil Myriapods of Nova Scotia, which will appear in the "Memoirs."

Dr. Thos. Dwight, Jr., made a brief report on the present condition of the collection of Dr. Jeffries Wyman, exhibiting a number of the more remarkable specimens in illustration.

The Wyman Collection consisted of something over two thousand specimens; from these were to be deducted a few pathological ones left to the Boston Society for Medical Improvement. Some two hundred and fifty invertebrates having been taken for other departments of our Museum, there came to the Department of Comparative Anatomy probably about seventeen hundred and fifty specimens. Many of these are of great value. Every specimen bears a distinctive label, so that it may be separated from those previously belonging to the Society. Among the more remarkable specimens should be mentioned the nearly complete skeleton (No. 1213, Wyman Catalogue) of a male gorilla, supposed to be the largest in any museum. The skeletons of gorillas and chimpanzees added to those already belonging to the Society, make our collection of anthropoid apes probably one of the finest in the world.

There are many very valuable series of specimens in this bequest, as of hearts, digestive organs, etc., but two of them are preëminent, namely, that of the nervous system and that of embryology. The former of these contains dissections of the central nervous system, which bear witness to the great skill of Dr. Wyman as a dissector. The cranial nerves of a torpedo are beautifully shown. There is also a collection of sections of bones, showing that they are constructed on architectural principles, an account of which Dr. Wyman published nearly thirty years ago.

The President announced the bequest, by Mrs. C. S. Hale, of Burlington, N. J., of her husband's scientific collection and library, the former containing the fine series of Zeuglodon vertebræ long since deposited in the Society's Museum. Also the gift of a fine painting of Prof. Louis Agassiz, by Mrs. C. V. Hamilton, purchased by the subscription of several members; and, finally, the gift from Geo. B. Emerson, Esq., of a complete series of the plates illustrating the new edition of the "Trees and Shrubs of Massachusetts," nicely framed and mounted for exhibition in the Museum. The thanks of the Society were voted for this valuable gift.

Section of Entomology. October 27, 1875.

Mr. S. H. Scudder in the chair. Eight persons present.

The following paper was read: —

NOTICE OF A SMALL COLLECTION OF BUTTERFLIES MADE BY MR. ROLAND THAXTER, ON CAPE BRETON ISLAND. BY SAMUEL H. SCUDDER.

The species are but fourteen in number, and were all taken on Cape Breton Island. The two Urbicolæ and *Eurymus Philodice* were also taken at Shediac. The species are the following: —

Basilarchia Arthemis.
Aglais Milberti.
Argynnis Cybele.
Argynnis Atlantis.
Brenthis Myrina.
Phyciodes Tharos.
Rusticus Scudderii.
Chrysophanus Epixanthe.
Heodes americana.
Eurymus Philodice.
Pieris rapæ.
Pieris oleracea.
Limochores Taumas.
Polites Peckius.

The following are the only ones worthy of special notice:

Argynnis Cybele. A single specimen was taken, whose forewing measures 37 mm. in length. It has the unmistakeable markings of *A. Cybele*, which has never before been taken so far north.

Rusticus Scudderii. Two males and two females were taken. The males do not differ from the usual form, except in having the markings of the under surface rather heavier. But the two females are undersized, measuring but 21 mm. in expanse; one of them has but few, and the other no, blue scales on the disk above; neither of them has a trace of any orange spots upon the outer border of the hind wings above, and very little, or no tinge of orange upon the outer border of the fore wings beneath. In all these respects, specimens from the southern coast of Labrador agree better with those from Canada and New York than with those from Cape Breton.

Chrysophanus Epixanthe. Whether *Dorcas* is distinct or not, I do not now venture to assert, but the specimens from Cape Breton belong to *Epixanthe,* and not, as we should expect, to the *Dorcas* type.

Eurymus Philodice. The most interesting insect brought home by Mr. Thaxter is unquestionably our common *E. Philodice.* The males hardly differ at all from the normal type, as found in New England, excepting in possessing a less conspicuous spot at the extremity of the cell in the fore wings above, although there, as here it varies to a considerable extent. In both sexes it is usually a very pale orange transverse spot, edged narrowly with dusky scales. The female, too, is dimorphic in both places, but whether yellow or pallid, Cape Breton specimens invariably show a uniform and considerable departure from the normal type. New England individuals have a very broad, dark border to the upper surface of the fore wings, extending down to the inner border, almost or quite as conspicuously as in the male, although not extending along this border toward the base; this marginal band encloses a curving submarginal series of ill-defined yellow (or pallid) spots; it is only occasionally so narrow that the spots are situated at its very edge; so, too, there is a marginal band upon the hind wings, like that of the males, though narrower, often broken, and with an ill-defined interior edge; this, however, is occasionally reduced to a few scattered grimy scales between the upper subcostal and middle median nervules, very much as appears in the female of *Eurymus Pelidne,* when they are present at all. Now in the females before me, from Cape Breton, the marginal band of the hind wing is either totally absent, or is reduced to a few scales clustered about the extremity of the subcostal nervules, and is, in only a single instance, continuous along the border between these nervules; while the border of the fore wing, broad indeed next the costal margin, narrows rapidly, and terminates usually at the lower median nervule, or, if it reaches to the submedian nervure, it is only by a few scattered grimy scales in the intervening interspace; the row of submarginal yellow (or pallid) spots would seldom be noticed, at least below the subcostal interspaces, but for a comparison with the normal type, or its continuance in the broader part of the band above. This is precisely what we find in *Eurymus Pelidne*, and so far as the upper surface of the pallid female is concerned, his species could scarcely be distinguished from the monomorphic *E. Pelidne*. The under surface of the Cape Breton insect, however, is dotted but lightly with griseous, and can be compared only to that of the true *E. Philodice*; although the submarginal spots of the hind wings, which are usually very conspicuous in New England specimens, never occur along the outer border in either sex of the Cape Breton type. The dimorphic pallid female, then, of the Cape Breton form of *Eurymus Philodice* approaches more closely the uniformly pallid female of the Labradorian *E. Pelidne*, than it does the normal dimorphic pallid female of its own species from New England. The gynandromorphic female of *E. Philodice*, whether of Cape Breton or of New England, finds, however, no parallel in Labrador, and the Cape Breton male agrees only with the Philodice-type. It should be added in this connection that the butterfly collected by Prof. Hamlin at Waterville, Me., on the strength of which I have once or twice in my list referred *Eurymus Pelidne* to northern New England, is nothing but the pallid female of this Cape Breton type, to which I would give the varietal name *laurentina*. Thirty-nine specimens were collected, of which ten were gynandromorphic females, eight pallid females, and the rest males.

Limochores Taumas. Specimens from this region, as shown both by Mr. Thaxter's collections, and others sent me several years ago by Mr. J. M. Jones, of Halifax, are remarkable for their smaller size, and the almost total absence of dull fulvous dusting upon the under surface of the hind wings, the upper and under surface being almost precisely alike in general tint.

November 3, 1875.

Vice President, Mr. S. H. Scudder, in the chair. Thirty persons present.

Prof. Morse remarked on the differences of some species of Mollusca as found in the aboriginal shell heaps, and at the present day, and which had been discussed at a previous meeting. He exhibited specimens of *Ilyanassa obsoleta* from shell heaps at Marblehead, which, in the drawn-out spire and thickened shell, showed important differences from the specimens of the species now living in the same locality.

Prof. C. H. Hitchcock briefly stated some conclusions he had recently reached concerning the stratigraphical structure of the Cambrian and Cambro-Silurian rocks of Western Vermont.

His observations led him to believe that Emmons understood the stratigraphical relations of these rocks (many of them called Taconic by him) better than most of his contemporaries, while the recent discoveries of fossils do not confirm the disposition of the great mass of the Taconic system as Cambrian.

Emmons believed these rocks were deposited successively against the western base of the Green Mountains; first the granular quartz, then the Stockbridge limestone, and lastly, the various slates which were capped by the black slates holding Olenellus, which is really the oldest member of the series. Prof. Hitchcock suggested as a better theory of structure, that sediments were formed contemporaneously, both upon the Green Mountains and the Adirondack side of the valley, thus making the granular quartz on the east side of the valley of the same age with the Potsdam sandstone at Whitehall, N. Y., and elsewhere west of Lake Champlain. Next, the Calciferous sandstone, Levis, Chazy and Trenton limestones, were deposited entirely across the valley, and by means of their fossils are now identified adjacent to both the quartz rock and the typical Potsdam sandstone. Thirdly, the limestones are succeeded by slates. This theory of original deposition differs from that of Emmons, in supposing that sedimentation was being effected both on the Green Mountain and Adirondack borders, instead of on the former only.

The origin of the present arrangement of the strata, with a usual easterly dip and numerous faults, may be understood by recalling the character of the folds in Ferrisburg, Monkton and Starksboro. The Potsdam sandstone occupies most of the country along this section, and there are at least six folds between Lake Champlain and the Green Mountains. First, the Chazy and other limestones in the

Ferrisburg valley; then after rising a few hundred feet, there is an undulating plateau through the east part of Ferrisburg and Monkton, consisting chiefly of the sandstone disposed in gentle folds. Between the last of the unmistakeable Potsdam rock and the quartz of Starksboro' is a development of the Calciferous sandrock. It would seem as if the quartz range is separated from the Calciferous by a fault. Next, east of this great quartz or Potsdam mountain, is a valley showing the Calciferous again, followed by the Potsdam quartz abutting against the Green Mountain schists, or with an overturn dip beneath them. The structure along this line is very plain, and consists of a series of folds.

Now we can follow these rocks southerly, and with their relative positions established in the north, can understand what the successive variations are. First we will examine the order in the next tier of towns south of Monkton. There is the anticlinal of Chazy, etc., with the fault west of Buck Mountain, in Waltham, bringing up the red Potsdam. This is overlaid by the Calciferous, Chazy and Trenton, with their natural easterly dips in New Haven, followed by the same formations in reverse order, with usually high overturn easterly dips and the Potsdam also. Continuing easterly, there are two more folds in the Potsdam covered by limestone, and then a broad band of Calciferous before reaching the high Bristol range of Potsdam quartz. This latter rock sinks down again, holding the Calciferous just as in Starksboro. The Potsdam quartz stands vertically against greenish schists in the town of Lincoln, which may possibly be of about the same age.

The following is the order, about twenty miles southerly of the last section, from Larrabee's Point in Shoreham to Goshen. Chazy. Trenton and Utica, occur in their natural order separated by a small fault from a Calciferous synclinal uplift. Then the Potsdam, probably the Buck Mountain range, follows on the east, overlaid by the Calciferous, Chazy and Trenton, reaching into Whiting. Probably the slate here overlies the Trenton. East of it the Chazy and Calciferous appear more than once, with high overturn easterly dips. The latter band is immediately adjacent to the Potsdam quartz. This latter range has certainly two anticlinal folds in it, covered by ranges of Calciferous. But on this section almost every dip is easterly, while the rocks can be traced directly to the north, where the westerly dips are as common as the easterly. The conclusion seems plain, that a greater pressure has inverted most of the folds, and caused fractures in many of them. Sections still further south illustrate the greater pressure and consequent larger irregularities in position with similar overturns. Prof. Hitchcock thought this theory of origin and method of disturbance, though involving numerous fractures, would enable geologists to understand perfectly the structure of the whole ground covered in the Taconic controversy.

In conclusion, the speaker remarked that these views would confirm the sections he had drawn across the Green Mountains, giving to that range an anticlinal form, whether exhibited naturally or inverted.

The Vice President announced that Prof. James Orton proposed to make a third South American exploration, and had selected the Rio Beni, as promising results of the greatest importance. It was voted that the chair appoint a committee of three to prepare a proper expression of the Society's interest in the proposed survey; and Messrs. Niles, Kneeland and Burgess were accordingly appointed.

November 17, 1375.

The President, Mr. T. T. Bouvé, in the chair. Fifty-nine persons present.

The following paper was read: —

Embryology of Salpa. By W. K. Brooks, Ph.D.

Students of the embryology of the various forms of Tunicata are so numerous and active at present, that the naturalist who refrains from publishing any new facts which he may acquire until the figures necessary for their illustration can be prepared, is very apt to find that they are no longer new. The following brief abstract of the more important points in the history of the development of Salpa has therefore been drawn up and presented to the Society, as the precursor of a more extended description which is now in preparation.

At the time when the Salpa-chain escapes from the body of the solitary form, each individual of the chain contains one ovum, which is inclosed within a capsule of epithelial cells, and is suspended in the sinus system of the "zooid" on the neural side, between the stomach and the atrial orifice, by means of a gubernaculum, by which it is attached to the wall of the branchial sac. (See Figure I.)

The ovum shows no trace of a vitelline membrane; the yolk is composed of transparent protoplasm without granules, and the germinal vesicle contains no dot, but seems to be homogeneous.

Impregnation takes place through the action of the spermatic filaments which are discharged into the water by the "zooids" of other fullgrown chains, are drawn into the branchial sacs of the immature "zooids" which contain the eggs, and penetrate into the interior of the gubernaculum.

Upon impregnation the germinative vesicle disappears; the gubernaculum becomes irregularly swollen and shortened, thus drawing the egg down into the brood-sac, which is formed by an involution of the branchical sac of the nurse (Figure II). The egg, nourished by the blood which bathes it, rapidly increases in size, and undergoes a process of *total* segmentation, as the result of which two portions are formed; a finely segmented "germ yolk," and a less completely segmented "food yolk." (Figure V.)

The latter becomes enveloped by the former through a process of invagination, forming a true "gastrula" or "invaginate planula," the opening of which, the "orifice of Rusconi," persists and forms the orifice of the placenta. (Figures VI, VII, VIII, *f.*)

The embryo, still growing rapidly, becomes divided into two portions by a constriction (Figure VII); the portion nearest the point of attachment to the brood sac forms the embryo proper, and the remaining portion that part of the placenta which is to be in communication with the sinus system of the fœtus. (Figure VII.)

Within this portion there is a cup-shaped cavity, part of the original "cavity of Rusconi," which is in direct communication with the sinus system of the nurse, and thus forms the second or inner chamber of the placenta. This soon becomes divided up into a great number of irregular intercommunicating lacunæ, which are produced by the growth of a structure resembling a stump with its roots, and which seems to be formed directly from the blood of the nurse, by the aggregation and fusion of the blood corpuscles.

The subsequent development of the fœtus, which is the young of the solitary salpa, is substantially as it has been described by Sars, Krohn, Vogt, Huxley, Leuckart and others, and I have been able to add little to what is known upon the subject.

The atrium of Salpa has been supposed to lack those lateral portions which, in most Tunicates, lie upon the sides of the branchial sac and are called the lateral atria; but at an early stage these seem to be present, as well as the mid-atrium, but the cavities of the lateral atria never become connected with that of the branchial sac by the formation of branchial slits; and at a very early period of development the walls of each lateral atrium unite, thus obliterating the cavity, and giving rise to a broad layer of tissue upon each side of the body, between the branchial sac and the so-called "muscular tunic," the "outer tunic" of Huxley.[1] Rows of transverse splits soon appear in these layers, which thus become divided to form the muscular bands, which latter subsequently become united to the inner surface of the outer tunic. (Fig. VIII, *m.*)

The sides of the mid-atrium become united at two points, one on each side, with the posterior surface of the branchial sac, and as the atrial and branchial tunics are free from each other between these regions of union, a median longitudinal sinus is thus formed which is the "gill" or "hypopharyngeal band." The central portions of the two regions where the tunics are united, are soon absorbed, and a single branchial slit is thus formed on each side of the "gill."

The earliest stages in the formation of the atrial chamber were not observed, but nothing was seen which seemed to indicate that it is formed, as in most Tunicates, by tubular invaginations of the outer wall of the embryo.

The cavity of the œsophagus is a prolongation of that of the branchial sac, and was in direct communication with this at the mouth when first observed. The stomach is formed as a diverticulum from the side of the œsophagus, and the cavities of the two were connected at all the periods observed, but the cavity of the intestine originates independently, and at first is closed at both ends; the partition between it and the stomach disappears first; that at the anal or atrial end persists some time longer.

The few facts which I have been able to add to what is known of the development of the salpa chain relate, for the most part, to the earliest stages in the development of this, which has always been considered the sexual generation; and seem to prove that the solitary

[1] This "outer tunic" must not be confounded with the "cellulose test" o Huxley, which covers it.

salpa is the female, and the chain salpa simply the male, which does not reproduce, but simply serves to fertilize and nourish the egg, so that we have, not an alternation of generations, but a very remarkable difference in the form and mode of origin of the two sexes.

The tube or stolon which is to form the chain first appears as a protrusion or diverticulum from the outer or muscular tunic of the solitary salpa, directly opposite the heart; this protrusion rapidly increases in length, and soon presents the form of a long tube closed at its distal end, projecting into the test, and with its cavity in direct connection with the cavity of the sinus system (the body cavity) of the solitary salpa, so that the blood of the latter enters and circulates freely within it. (Figure X.)

A second tube with very thick walls and a very narrow cavity now grows out from the pericardium, crosses the sinus and penetrates the cavity of the outer tube almost to its tip or blind end, and soon becomes flattened and its edges unite with the walls of the outer tube, which thus becomes divided into two chambers, which are entirely separate from each other except at the tip. The blood now passes into one of these chambers at its base, and is driven up to the blind end where it passes around the partition, back through the other chamber to the sinus of the parent. It is of course unnecessary to state that when the circulation of the parent is reversed that of the stolon changes also.

By the formation of the partition above described the tube is divided longitudinally into halves, and each half is destined to be converted into the series of "zooids" on one side of the chain. The outer wall of the tube, which has been shown to be part of the muscular tunic of the parent, becomes the muscular tunics of the "zooids"; the chambers, which are continuous with the sinus system of the parent, form the body cavities or sinus systems of the "zooids," and the central tube, which is a prolongation of the pericardium of the parent, forms the nervous, digestive and branchial organs of the "zooids" of the chain. It is probable that the cavity of this inner tube gives rise to lateral diverticula, which form the cavities of the digestive organs and branchial sac of the young, but this point could not be determined with certainty, nor could any connection between the cavity of this inner tube and any of the cavities of the parent be discovered.

Before the tube becomes differentiated into the organs of the "zooids," in fact, before there are any indications that the tube is to give rise to the chain, two new organs are formed, one in each of the sinus chambers of the stolon. These new organs are long club-shaped masses of protoplasm, which are not at first attached to the tube, but are free within the chambers, and do not seem to be derived from any of the pre-existing parts of the solitary salpa, but are formed directly from the blood. As the tube grows these organs lengthen as well, and soon a row of germinative vesicles is seen extending along each of them; they are the ovaries. (Figure X, *x*.) At the time that the constrictions, which are the first indications of the "zooids," make their appearance on the outer wall of the tube, each ovary is seen to be made up of a single row of eggs, equal in number to the constrictions which indicate the number of the future "zooids," and as these latter are developed, and their sinus systems become separated from the common cavity of the tube, the chain of ova divides, so that a single egg passes into the sinus system of each "zooid," and becomes suspended there by a gubernaculum, by means of which it is attached to the wall of the branchial sac, as already described.

Since the chain salpa at birth always contains an unimpregnated ovum, organically connected with its body, and since this egg and the resulting embryo are nourished by the blood of the chain salpa by means of a placenta, and since no reproductive organs have ever been observed within the body of the solitary salpa, it seems most reasonable to accept the belief that the solitary salpa is the asexual, and the chain salpa the hermaphrodite sexual generation, and that the developmental history of the genus presents a true example of "alternation of generations." When, however, we have traced backward the history of one of the "zooids" which compose a chain, and find that the egg is present at all stages of growth, and is of exactly the same size and appearance as at the time of its impregnation; when we find one organ after another disappearing, until at last we have nothing but a faint trace of a constriction indicating upon the wall of the stolon the position of the future "zooid," the conclusion seems to be irresistible that the animal, which has as yet no existence, cannot be the parent of the egg which is already fully formed.

The life history of Salpa may then be stated in outline as follows: The solitary salpa is the female, and produces a chain of males by budding, and discharges an egg into the body of each of these before birth. These eggs are impregnated while the "zooids" of the chain are very small and sexually immature, and develop into females which give rise to other males in the same way.

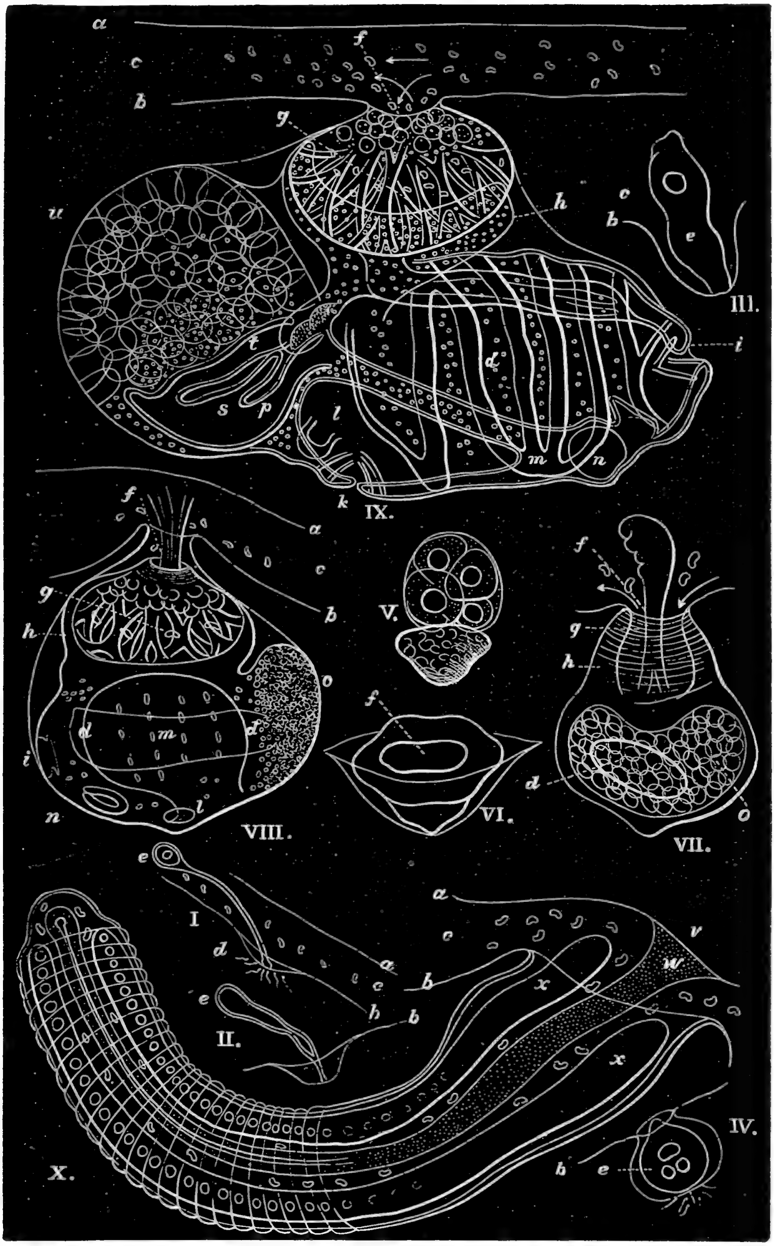
After the fœtus has been discharged from the body of the male the latter attains its full size, becomes sexually mature, and discharges its spermatic fluid into the water to gain access to the eggs carried by other immature chains.

The fact that impregnation takes place, not, as we might expect, within the body of the solitary, but within that of the chain salpa, is no objection to this view, for the number of animals whose eggs are fertilized within the body of the female is quite small, and in at least one genus, Hippocampus, the eggs are received into a specialized brood sack in the male, and are there impregnated.

We can also find analogy for the singular fact that the eggs always develop females, while the males are formed by budding. The fertilized eggs of the bee always give rise to females, while the males are developed by the virgin bee, through what seems, as pointed out by Prof. McCrady, to be most properly regarded as a process of internal gemmation; and we cannot fail to mark the very striking parallelism between the process of reproduction as manifested in Salpa and the bee.

The fertilization of the eggs within the bodies of "zooids" produced by budding from the body of that whose ovary gave rise to the eggs is not unusual among the Tunicata. The "zooids" of most of the Tunicata are hermaphrodite, and develop eggs of their own, but, at least in the case of Pyrosoma, Perophora, Didemnium and Amauricium, the egg which undergoes impregnation and development within the body of the "zooid" is derived, not from its own ovary, but from that of the generation before, and the eggs produced in the body of the second generation must pass into the bodies of the "zooids" of the third generation before they can be fertilized. The essential difference between this process and that presented by Salpa, is that in Salpa the sexes are distinct, and as the chain salpa has no ovary the process of budding stops with the second generation; while as the "zooids" of the other Tunicata are hermaphrodite the process may go on indefinitely.

The history of Salpa is of especial interest, as it throws a great deal of light upon the manner in which separation of the sexes may be brought about in forms which were originally hermaphrodite, and it is also interesting to note that the elæoblast, the history of the development of which shows it to be the homologue in the female of the testicle of the male, is concerned in reproduction, although it has lost all the characterstics of a sexual organ, and is simply a supply of food.



W. K. BROOKS. EMBRYOLOGY OF SALPA

We cannot fail to notice the connection between the manner in which the male salpa is produced, and the numerous cases, through the various groups of the animal kingdom, in which the male is, to some extent, parasitic upon, or supplemental to, the female.

The Cirrhipeds, Arachnids and the Argonaut, will at once suggest themselves, as familiar instances of the occurrence of such a relation between the sexes.

These interesting theoretical points are simply mentioned here, as a more exhaustive discussion of them is reserved for another place.

EXPLANATION OF PLATE I.

The small letters have the same signification throughout.

a. Wall of branchial sac.
b. Wall of outer tunic.
c. Sinus cavity.
d. Branchial cavity.
e. Egg.
f. Opening of inner chamber of placenta.
g. Cavity of inner chamber of placenta.
h. Cavity of outer chamber of placenta.
i. Branchial aperture.
k. Atrial aperture.
l. Cavity of atrial chamber.
m. Muscles.
n. Ganglion.
o. Nucleus.
p. Œsophagus.
s. Stomach.
t. Intestine.
u. Elæoblast.
v. Pericardium.
w. Inner tube of stolon.
x. Ovary.

Figure I. Egg within the sinus system, and attached by a gubernaculum to wall of branchial sac, within the cavity of which a few spermatic filaments are seen.

Figures II, III, IV and V. Successive stages of segmentation.

Figure VI. Gastrula within the brood-sac.

Figure VII. Embryo, soon after the primitive digestive cavity has become divided into the branchial and placental chambers.

Figure VIII. Embryo considerably advanced, showing the mid-atrium, *l*, and one of the lateral atria, *m*, which has already begun to split and form the mnscles.

Figure IX. Embryo at about the time that the stolon appears.

Figure X. Stolon, at a very early stage, showing the ovaries, *x*, *x*; [in this figure the letters *a* and *b* were accidentally transposed, so that *b* represents the outer tunic, and *a*, the branchial sac].

The President, with a few warm words of welcome, then introduced Professor James D. Dana, who, after some general remarks on the subject, read a paper on the relations of Pseudomorphism to Metamorphism, in reply to Prof. T. Sterry Hunt's criticisms published in the Proceedings of the Society for June 2, 1875.

Professor Dana stated his objections to various statements in Professor Hunt's article, gave his reasons for denying that he held, or had held, the views which Professor Hunt had attributed to him, and stated that if Mr. Hunt had admitted in 1871 that Prof. Dana's Manual of Geology contained a fair exposition of its author's views on Metamorphism, the controversy would never have had a beginning.

Dr. Sterry Hunt responded that, as Prof. Dana had declared that his earlier expressions as to the relations of Pseudomorphism to Metamorphism had been misinterpreted, and that he had never, to his knowledge, held the views attributed to him, although he did not complain that under the circumstances a misapprehension had in the first place occurred, he (Dr. Hunt) was free to say that he regretted the misapprehension on his part, and that it is now evident that Prof. Dana's Manual of Geology of 1863 correctly expresses the author's views.

The Secretary presented by title, "A Prodrome of the Tabanidæ of the United States," Part II, by C. R. Osten Sacken, which will appear in the Society's Memoirs.

The Custodian announced the gift, by Capt. Charles Bryant, of a fine skeleton and a skull of the Sea-lion, and skeletons of two Fur-seals, for which the thanks of the Society were voted.

Section of Entomology. November 24, 1875.

Mr. George Dimmock in the chair. Nine persons present.

Mr. B. P. Mann exhibited male and female specimens of *Anisopteryx vernata*, one of the males having undeveloped wings, and male and female specimens of *A. pometaria*, including three males with undeveloped wings and one female with wings partially developed.

The latter specimen is a much more striking example of the possession of wings by a female than the one described in these Proceedings, xvi, 163–165. The right hind wing is nearly as much developed as the corresponding wing in the normal males, the other wings are more developed than in the specimen formerly described; the antennæ are pectinated, but the female showed no signs of hermaphroditism.

In connection with the exhibition of these specimens, Mr. Mann called attention to an article just published by Mr. Riley in the Trans. St. Louis Acad. Sci., in which Mr. Riley gives in detail the characters drawn from every stage of life of these two species, showing that the differences in character of each stage would be of specific value, independently of the characters in the other stages, if no intermediate forms were found, which thus far has been the case

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December 1, 1875.

Vice President, Mr. S. H. Scudder, in the chair. Twelve persons present.

Mr. Scudder gave a short account of the geographical distribution of *Vanessa cardui* and *V. atalanta*, the two most widely ranging species among the butterflies. The former had been hitherto supposed by entomologists to be of European origin, but the speaker showed that the group of Vanessa to which it belonged was confined to the American continent, where he believed therefore that *V. cardui* was really indigenous.

Dr. Chas. Pickering observed that *V. cardui* was not found in the Hawaiian Islands at the time of his visit in 1840, and probably not in Tahiti.

Dr. J. B. S. Jackson exhibited, and presented, a portion of a tree trunk from the submarine forest at Provincetown.

The following paper was read: —

Notes on some Fishes and Reptiles from the Western Coast of South America. By S. W. Garman.

The specimens from which the following notes are taken were collected at different points along the coast from Peru to New Grenada. The collection was made for Mr. Alex. Agassiz, and by him given to the Museum of Comparative Zoology. It is especially interesting on account of the representatives of recently described and new species it contains.

Fishes.

Gobius transandeanus Günther.

Eighteen specimens were obtained at San Jose, one of the Pearl Islands. They were found to be numerous in the pools left by the tide on the shores.

Batrachus pacifici Günther.

One specimen from the island San Miguel. When removed from its hiding-place, under a rock on the beach some distance above low tide, the animal grunted so lustily as to be heard at a distance of a couple of rods.

Thalassophryne reticulatus Günther.

From the Bay of Panama. Presented by the well known naturalist, Capt. J. M. Dow.

Atherinichthys microlepidota Günther.

Coast of Peru.

Mugil Rammelsbergii Tschudi.

The two preceding are very common species on the Peruvian coast. They were the most abundant fishes in the market during the months of December and January.

Sicyases Petersii sp. nov.

Dorsal fin with six rays; anal six. Incisors tricuspid, eight nearly vertical upper, six oblique lower; at each end of the series, above and below, are two curved canines, of which the posterior is the longer. Head as broad as long, prominent in front of the eyes. Subopercular spine medium. Body wedge-shaped. Skin tough, naked. One third of the base of the dorsal anterior to that of the anal. Color olivaceous brown, with a series of six or seven dark brown spots on the back, and twice as many triangular ones on the lower half of the sides. From the eye there are three white bands, two over the opercle, and one, to the end of the muzzle, on the lip. Belly whitish, uniform. A band of brown crosses the caudal fin. In some specimens the markings are very obscure. Length 1.3 inches (33 mm.).

Sixteen specimens, from San Jose, San Miguel and Saboga. These fishes were numerous in the little pools among the rocks on the shores of these islands. On being hard pressed by attempts at capture they would run to the water's edge, and by jumps of considerable length, throw themselves into the water again at some distance from the point of attack. A wet surface on which there was no appreciable depth of water connected two small basins which were about two feet apart; this was traversed several times by some of the fishes before they could be taken. After the water had all escaped from the pool they were to be found hidden under the coarse sand in the bottom.

This species is brought into notice in the name of the very eminent zoologist, Dr. Wilhelm Peters of Berlin.

The known species of the genus are

S. sanguineus Müll. u. Trosch. Chili.
S. chilensis (Barnev.) Günth. Chili.
S. fasciatus Peters. Caribbean Sea.
S. Petersii sp. nov. Bay of Panama.

Sternopygus carapus Günth.

The scales on these fishes are invisible until the mucus which covers them is removed. They were very abundant in the Guayaquil River. Great numbers were taken by the natives with large dip-nets, at the mouths of little creeks and inlets as they came in with the tide.

Muræna melanotis Günth.

Numerous amongst the Pearl Islands.

Batrachians.

Bufo agua Latr.

Specimens which were rough with small spines, and others quite smooth, were taken from a pond on the island Saboga.

Reptiles.

Phyllodactylus tuberculosus Wiegmann.

Fourteen rows of tubercles. A band of brown from behind the eye over the ear, and traces of six transverse bands on the back between the occiput and hips; these are probably more distinct in the young. Two specimens from the Daule River, Ecuador.

Anolis sp.

Small, form slender. Head narrow; muzzle long. Tail very slender, more than twice as long as the head and body, with larger scales on its upper surface. Scales keeled on body, head and tail; those of the abdomen larger, of the sides granular. On the back the hexangular scales of the median series are larger than those of the sides. Goitre small. Back and nape simple. Posterior limb and foot as long as the head and body; anterior as long as the body from shoulder to hip. Expansions on the toes very slight. Supraorbital series of eight scales, separated from each other by two series, and from the small oval occipital by four. Upper labials eleven. Colors reddish brown and green, bronzed; with a series of elongate, more or less confluent brown spots on each side of the dorsum from the ear to the tail. Indistinct bands of brown on legs and tail. Head darker than body; ventral surface lighter. Total length, 5.5 inches. Body, 1.7 inches. From Saboga, two specimens.

Microlophus peruvianus Gray.

Dark colors in transverse bands. Just above and in front of the thigh there is a brick-red band reaching forward to the middle of the flank. The large occipital is surrounded by a series of medium sized plates; a diminishing series of four or more extends laterally from its sides. A young specimen and an adult with eggs were obtained at Lima, Peru.

Liophis bicinctus Dum. et Bibr. Var.?

Body stout. Head little larger than the neck. Tail short, strong. Cephalic plates normal; rostral medium, wider than high; frontals and prefrontals wider than long; vertical hexangular, broad; loral small, quadrangular; one preocular; two postoculars; temporals one and two; upper labials eight, fourth and fifth in contact with the eye; lower nine, fifth pair largest; anterior pair of inframaxillaries twice the size of the posterior. Eye moderate, lateral; pupil round. Posterior maxillary teeth larger, smooth, separated from the others by an interspace. Dorsal scales nearly as wide as long, smooth, in twenty three rows. Abdominal scutellæ two hundred and eight. Anal entire. Subcaudals thirty-nine pairs.

Colors red, black and white, in transverse rings. Body encircled by sixteen rings of red, from six to fifteen scales in width, separated by fifteen pairs of black rings, from two to three scales wide, each pair enclosing a single white ring from three to five scales in width. Each scale in the white has an oval spot of black in its centre. These rings extend quite around the body; the black grow narrower on the abdomen. All the shields of the head are marked with black; the rostral has a spot in its centre; a large spot covers the junction of the first pair of lower labials with the inframaxillaries, and a wide band passes over vertical and supraorbitals through the eye on the fourth and fifth labials. A narrow band of black, two scales wide, passes around the head behind the occipitals, and in front of the first band of red fifteen scales in width. Total length, 30.5 inches; tail, 3.4 inches.

From the Daule River, Ecuador, one specimen.

Brachyryton clœlia Dum. et Bibr.

Daule River, Ecuador.

Leptognathus nebulatus Günth.

In both specimens the dark bands are margined with white; one has a rudimentary anteorbital below the loral on each side. Length of one example, 16.5 inches; tail, 4 in. This specimen has one hundred and ninety-three abdominals and eight pairs of subcaudals. Daule River, Ecuador.

Eteirodipsas annulata Jan.

One of these specimens is quite young, and has the brown of the back and sides in continuous longitudinal bands; excepting slight sinuations in the anterior portion of the dorsal band, there is no indication of the spots. Daule River, Ecuador. Seven specimens.

Elaps Dumerili Jan.

Its common name, "Culebra coral," or Coral snake, is applied to all red banded snakes, of whatever genus or family. No band of lighter color on the head in front of the eyes. The black of the head extends upon the lower labials.

Bothrops pictus Jan.

One specimen from Lima, Peru.

Section of Microscopy. December 8, 1875.

Mr. E. Bicknell in the chair.

The following paper was read:—

A Contribution to Microgeology. By Charles Stodder.

The "infusorial deposit" of Richmond and other Virginian localities was discovered by Prof. W. B. Rogers about 1842 (Am. Journ Sci., vol. XLIII).

Prof. J. W. Bailey gave (in Am. Journ. Sci., 1844, 5) descriptions and lists of various organic forms found by himself and by Ehrenberg in this deposit. Ehrenberg also published from time to time, and especially in his great work, Microgeologie 1852, accounts of his discoveries. Since then the Richmond earth has been a subject of interest to geologists and micographers throughout the scientific world. At various times eminent microscopists both in Europe and America have discovered, and added to the lists, a new species that had escaped the searching of Bailey and Ehrenberg. But from all that has been published by either of those renowned micographers and all their successors, there has been an important omission. The stratum containing the fossils in Richmond is stated generally to be twenty feet thick. In all the published accounts that I have seen there has been no mention of the depth in the stratum from which the specimens were taken. A deposit of microscopic vegetable and animal remains of twenty feet in thickness, from twenty to eighty per cent. only being mineral, would require a long period of time — ages probably — for its accumulation. During all that time were the conditions of life such as to maintain the existence of the same species and genera? or were there changes of climate or physical conditions sufficient to induce changes in the species and genera? Nothing that I have been able to find in the literature of the subject throws any light on the question.

For some years I have been endeavoring to obtain authentic specimens of the deposit that might give some information on the question, but without success until the last year, 1874, when Mr. R. B. Tolles visited Richmond, and with considerable trouble and annoyance procured from Shockoe Hill (one of the well known localities) seven specimens from as many different layers of the deposit.

The locality is a ravine on the westerly side of the hill. The specimens were taken from the southerly side of the ravine at five feet, seven feet, seven and one-half feet, ten feet, eleven feet and fourteen feet below the top of the bank; besides one from the north side forty feet below the top, from a bed apparently the continuation of the fourteen feet bed on the opposite side, the hill being higher on the north side. The first specimen, at five feet depth, was surrounded by the roots of a large tree standing on the summit of the bank, and contains numerous vegetable fibres.

All the specimens are similar in appearance (except that from fourteen feet in depth, which is much darker) of a light drab color very like clay, very low specific gravity, a little heavier than water, and more or less stained, apparently by iron, which seems to act as a cement. Now they are dry they are hard, but not so hard that they cannot be crushed in the fingers. The forty feet specimen from the northerly side has the darker color of the fourteen feet sample.

I have cleaned and prepared for microscopic study portions of the five feet, eleven feet, fourteen feet and forty feet samples. Some are more difficult to clean than others, the iron cement adhering very tenaciously, and being very difficult to remove.

The upper layers present, as might be anticipated, more differences from the others than they do from each other, viz., there is a smaller proportion of organism, and larger of mineral, I estimate about twenty per cent. organic and eighty per cent. sand, with many vegetable fibres and roots. The diatoms are in a more perfect condition, a larger proportion being whole and uninjured, while in the deeper layers they are more broken, the fine fragments of the siliceous valves exceeding in bulk the entire or whole frustules. The lower layers contain from fifty per cent. to eighty per cent. of organic forms of which the Diatomaceæ constitute by far the greatest part.

The deeper we go, the larger is the proportion of debris or broken frustules. There was so little variation in the contents of the specimens examined that I have not undertaken the great labor of cleaning the other specimens.

I annex in a tabular form a list of the species identified in the different layers. From this it will be seen that there is no essential change of forms from the lowest until we come to the upper or five feet layer, indicating that during all the time required for the gathering of this great accumulation of these minute remains there were no great changes of physical conditions to influence the life and growth of these forms. The five feet layer then gives indications that some changes were taking place, by the disappearance of genera or species that flourished in earlier periods.

Miocene Richmond Infusorial Deposit.

DIATOMACEÆ.	5 ft.	11 ft.	14 ft.	40 ft.
Actinoptychus senarius		o		o
" biternarius	o	o		
Omphalopelta punctatus	o	o		
" versicolor		o		
Actinocyclus Ehrenbergii			o	
Coscinodiscus radiolatus		o		
" punctatus, oval and spherical varieties.	o	o	o	o
" lineatus		o	o	
" velatus	o	o		
" marginatus	o	o		
" radiatus		o	o	
" gigas	o	o	o	o
" oculis-iridis	o	o	o	
" perforatus	o			
" centralis			o	
" subtilis		o		
Systephania corona		o	o	o
Aulacodiscus crux	o			
Craspedodiscus coscinodiscus	o	o	o	o
Asterolampra Brebissonii Greg.		o	o	
Eupodiscus Rogersii	o			
Endictya oceanica				o
Pyxidicula aculeata		o		
Stephanopyxis diadema		o		o
" apendiculata		o	o	
Xanthiopyxis globosa		o		o
" hirsuta		o		
" oblonga				
Rizosolenia americana	o	o	o	o
Goniothecum odontidium	o	o	o	o
" Rogersii	o	o	o	o
Dicladia capreolus			o	
Chætoceros sp.		o		o
Biddulphia Toumeyii	o	o	o	o
Triceratium reticulum		o		
" undulatum		o		
" condeconum		o		o
" obtusum	o		o	o
" marylandicum		o	o	o
Mastogonia actinoptychus	o			
Rhaphoneis amphicerus		o		
Grammatophora marina		o		
" africana		o		
Navicula (Pinnularia) perigrina		o	o	
" viridis		o	o	o
" viridula				o
Pleurosigma = Nav. sigma Eh.—very like P. angulatum.		o	o	o
Stephanogonia polygonia.		o		o
Orthosira marina W. S. = Galionella sulcata Eh.	o	o		
Fragilaria pinnata		o		
RHIZOPODS.				
Actinisceæ — Actiniscus pentasterias	o	o		
Dictyocha crux	o			
" fibula	o			
Mesocenia diodon	o			
Polycistinæ, various	o			o
Phytolitharia Eh.—Spongolithis accicularis, S. caputserpentis; spines of Polycistinæ, Acanthometra and others	o	o	o	o

It has not been thought advisable to attempt to identify all of Ehrenberg's species, as his plan was to found a species upon any variation in the number of rays in the circular forms of the Diatomaceæ, a principle now generally rejected.

One striking fact is the great abundance in all the layers of *Galionella sulcata* Eh. = *Orthosira marina* W. Smith, which is more numerous in some slides than all the other forms together.

December 15, 1875.

The President, Mr. T. T. Bouvé, in the chair. Sixteen persons present.

The following papers were read:—

Ancient Hearths and Modern Indian Remains in the Missouri Valley. By W. J. Hoffman, M. D.

ANCIENT HEARTHS.

The Military Station at Grand River, D. T., is situated upon the western bank of the Missouri River about midway between Fort Sully and Fort Rice: approximate location, long. 100° 12′ W., lat. 45° 31′ N. About three hundred yards from the river the bottom-land is walled in by a range of bluffs, about one hundred and twenty feet in height, the upper surface of which corresponds to the level of the surrounding prairie. Three quarters of a mile below the station, Oak Creek empties into the Missouri River, thus forming a low head-land or spur, the ridge of which still bears evidence of aboriginal occupancy. Grand River empties into the Missouri from the west also, three miles below the station, where the Mound Builders once threw up earthworks, traces of which are still visible.

During the spring flood of 1873 about twelve feet of the embankment at the station was washed away, exposing to view two distinct river beds. The height of the embankment is twenty-two feet. The upper stratum, which was composed chiefly of sand and gravel, was ten feet thick, resting upon the fine sand of the upper surface of the second stratum. Throughout the bottom of the upper stratum was deposited an indiscriminate mixture of branches, trunks and stumps of trees, consisting chiefly of cottonwood, oak and cedar. The second stratum was six feet thick, also consisting of coarse sand and gravel, terminating upon the upper surface of a third layer of sand, upon which rested a thin layer of fine charcoal, and larger fragments of charred wood. The sand upon which the fire had been built was reddened by the heat to the depth of an inch and a quarter ; the overlying layer retaining the natural tint, appearing as if the fire had been suddenly extinguished. The extent of the layer of ashes (or fine charcoal) was about five feet in diameter, around which, at irregular intervals, lay a number of dark blue silicious stones, also reddened by oxidation on those sides facing the fire. Quite a number of fragments of chipped quartzite lay scattered above and below this hearth, in the same seam. About eighty yards up the river, another seam of charred wood and ashes was exposed, also showing the red and burnt condition of the gravel underlying it. It is a difficult matter to advance any theory as to the age of these hearths. When the station was established seven or eight years ago, the whole valley was covered with heavy timber. Stumps of cottonwood, sycamore and oak, found standing nearly over the hearths, measured over four feet in diameter, and trees of equal size are still flourishing both above and below the station.

The bluffs, which belong to the cretaceous formation, are filled with fossil bivalves, and in several localities we find beds of dark blue plastic clay, containing fossils, prominent amongst which are the *Nautilus Dekayi* and *Ammonites Placenta*, which are found mixed with the drift detritus from the plains ; these are found in the upper stratum only, as the second stratum, at the bottom of which the hearths lay, was probably deposited when the river's course lay near the opposite banks, where the cretaceous rocks do not protrude; it is well known that rivers continually tend to shift their courses. For a distance of five miles on either side of the station the valley is comparatively straight, but within it the river winds considerably. Lyell[1] says of the Somme, when, in one of its curves, the current crosses "its general line of descent, it eats out a curve on the opposite bank, or in the side of the hills bounding the valley, from which curve it is turned back again at an equal angle, so that it recrosses the line of descent, and gradually hollows out another curve lower down in the opposite bank," till the whole sides of the valley "present a succession of salient and retiring angles."

The river is also working a deeper bed which is apparent; but what length of time was consumed in depositing these strata of sand

[1]Lyell's Principles, p. 206.

and gravel, and the changing of its course from the western to the eastern side of the valley is difficult of determination. During the season of floods, ice gorges have been formed in the main channel, which caused the water to take a new course, which in a short period became the navigable current, thus leaving an island as it were, between the old and new courses, as appears to have been the case at Grand River. Mounds and other primitive earthworks occur from Bonhomme Island to the mouth of the Yellowstone, and up that river for a distance of over three hundred miles. There are no mounds or ancient earthworks in the immediate vicinity of the settlement, except the one at Grand River, which has been described by Mr. A. Barrandt, in the Smithsonian Report for 1870, p. 406.

MODERN REMAINS.

Modern remains exist showing that the bluffs and prairie were once the home of a powerful tribe. Many of the Sioux are still living, who, with their tribe, in moving up the Missouri River reached that point where the military station is now located, and found a tribe with whom they engaged in battle. After an engagement lasting four days, the Sioux were victorious and drove the conquered people up the river as far as the present sites of Forts Berthold and Stevenson. This occurred in the year 1818.

All that remains of the Ree villages,— for this was the tribe,— are immense numbers of low mounds, scattered, or in groups, and extending along the bluffs over an area of several miles either way. The most southern point occupied, was the spur formed by the union of Oak Creek and the Missouri River. This group covers an area of nearly an acre, and is surrounded by a ditch, which was originally six feet wide, and two or three feet deep. Portions of the ditch have become indistinct by filling up with the drift material from the surrounding prairie. The mounds are usually from three to six feet in diameter, and sometimes reach from twelve to fifteen feet in height, although the majority of them are nearly leveled and would be overlooked by a casual observer.

They are composed of hard mud — no doubt at one time adobe, sand, fragments of quartzite, jasper, agate and chalcedony, pieces of broken pottery, but more especially of bones, amongst which I found those of the buffalo in excess; also elk, antelope, bear, and smaller bones, especially those of the Rodents and aquatic birds, with scales of the sturgeon. After digging down to the depth of about two feet, the splinters of bone were more numerous than on the surface, and in not a single instance have I found any bones that had been subjected to the effects of fire, but the marrow had been removed by splitting the bones with a stone or maul, as no indentations, such as would be caused by an edged tool, were visible.

None of the fragments of pottery indicated that any large vessels had been used, but some of the designs corresponded precisely with specimens obtained near the Rio Verde, Arizona. The latter are usually glazed, an art which seems to have been unknown to the Rees at that time. The texture of these specimens is rather fine, and the color usually dark; the indentations have been made with a small piece of wood, although in some of the ornamentation the fingers were employed, as the five impressions show. The pottery does not seem to have been baked, but sun-dried; this, however, is merely a matter of conjecture, as the condition of the specimens after long exposure has become considerably changed. Arrow-heads and kindred flints were abundant. The smallest arrow points measured but .4 of an inch in length, the typical form being triangular. The finest point was one made of black silicious rock, three inches long, and three quarters of an inch wide. It was knife-shape, *i.e.*, rounded at the one end like the blade of a common table knife, and elegantly notched at the base.

Bone implements were not rare; the finest piece of workmanship being a fish-hook only an inch in length, and finely notched for attachment to the line. These specimens were no doubt preserved from decomposition by the dryness of the sandy soil covering many of these refuse heaps, and the dry atmosphere common over the country between the Missouri River and the Rocky Mountains.

On certain land-locked Ponds as natural Meteorological Registers. By L. S. Burbank.

It is well known that among the small lakes or ponds so numerous throughout New England, there are many which are entirely land-locked, no water flowing from them at any season of the year.

Some phenomena observed in a small pond of this kind in Lancaster, Mass., have suggested that valuable results might be attained by more accurate and extended observations upon similar bodies of water throughout the State.

The pond referred to is known on the town and county maps as Cranberry Pond. On a recent map of Worcester County, it is incorrectly represented as the source of one of the branches of the Nashua River. In fact, no water flows from it at any season, nor does any stream flow into it. Although its area is small,—only about thirteen acres, its depth in some parts is sixty or seventy feet. It occupies one of the deepest valleys in a mass of glacial drift which covers an area of two or three square miles, and which is very remarkable for its uneven surface, steep slopes, deep hollows and long and narrow ridges.

The height of the water in the pond varies through a vertical range of about six feet. It is a common saying among the inhabitants of the vicinity, that *the water is highest in a dry time*, and also that it *rises and falls regularly once in seven years.* These sayings are not altogether without foundation in facts. The water is often higher in dry weather in mid-summer than during the copious rains of the Autumnal Equinox. That there are, also, fluctuations ranging through several years, is illustrated by the following facts, observed about the year 1852.

For several years the water had been quite low, and a dense growth of Pitch Pine (*Pinus rigida*) had grown up along the margin, near the water. After these pines had attained about seven years' growth, the water rose several feet, and stood above their roots during at least one whole season, and until the trees were all killed by the moisture.

It is not necessary to seek an explanation of these facts in the popular notion that the pond is fed entirely by springs at its bottom, or has a hidden outlet by which its waters are discharged at intervals. The height of the water is undoubtedly regulated by the combined effects of the rainfall and evaporation.

The inference is obvious that careful measurements and records of the varying height of the water in such ponds throughout the State, continued for a series of years, would aid in the solution of several important questions relating to our climate.

1. The ratio of evaporation to rain-fall may be determined.

2. The question whether our climate is gradually growing dryer may be solved.

3. The effects of forests upon precipitation and evaporation may be studied by the aid of observations made upon such ponds when surrounded by woodland, and afterwards, when the forests have been cleared away.

January 5, 1876.

The President, Mr. T. T. Bouvé, in the chair. Thirty-eight persons present.

The following gentlemen were elected Resident Members: Messrs. A. Graham Bell, Lucien Carr, Charles B. Cory, Samuel D. Crafts, John A. Jeffries, William A. Jeffries, and Clifford R. Weld.

Prof. W. H. Niles read a paper entitled "The Evidences of a widely spread Geological Force, exhibited by certain Rock movements."

Mr. L. S. Burbank exhibited specimens of the wood, leaves, and fruit of two species of native forest trees, the River Birch (*Betula nigra*) and the Hackberry or Nettle Tree (*Celtis occidentalis*).

These trees are both very rare in New England. The River Birch, which is well described in Emerson's Report on the Trees and Shrubs of Massachusetts, is not known to occur anywhere in New England, except on the banks of the Merrimack and some of its smaller branches. The only locality mentioned by Emerson is on and near the Spicket River, in Methuen (now the City of Lawrence), a few miles below Lowell. It is found, however, in great abundance in Lowell, and along the banks of the Merrimack for several miles above and below that city. It attracts attention at once by the peculiarity of the bark, which is of a reddish brown color, and has a ragged appearance, due to the fact that the outer layers separate and hang from the branches and smaller trunks in loose, curled masses. The bark on the larger trunks is dark colored and very rough, having little resemblance to that of the branches, or of any other species of birch. The trees of this species appear to grow naturally only on the immediate banks of the streams, where they are generally much injured by floating ice and driftwood, and seldom show the vigorous growth and graceful forms that characterize the species in specially favorable locations.

A group of these trees that stood on the bank of the Merrimack just above the mills of the Lawrence Corporation in Lowell, contained several individuals of remarkable size and beauty. One of these was undoubtedly the largest of its kind in New England. Its graceful form and long, drooping branches gave it, when seen from a distance, much the aspect of an elm. This noble tree has recently been destroyed to make room for a new building. Fortunately, a record of its dimensions (as measured, in 1871, by Mr. Russell, of Providence, and myself) has been preserved. Its circumference at the ground was 9 ft. 7 in., at four feet above, 8 ft. 6 in. The spread of the branches was seventy-five feet. Several large trees of the group are still standing. One of these now measures 7 ft. 6 in. in circumference at four feet from the ground. Its branches extend in one direction forty-one feet from the centre of the trunk, and in a direction nearly opposite, thirty feet. Several other trees of the group measure from five to seven feet in circumference. Micheaux[1] states, rather indefinitely, that this species never exceeds two or three feet in diameter. He also gives the northern part of New Jersey as the northern limit of its growth.

The facts given above indicate that it does not suffer from the effects of our colder climate, but attains quite as large a growth in the valley of the Merrimack as in the southern States. It flourishes well in cultivation, and is well worthy of a place among ornamental trees for public and private grounds.

The Hackberry, *Celtis crassifolia*, is regarded as identical with *Celtis occidentalis* by Dr. Gray, who describes only one species of Celtis as occurring east of the Mississippi. Micheaux and Emerson make them two distinct species.

From observations that I have made on the western variety, as well as that which occurs in this State, I have no doubt that both belong to the same species, and that the very marked differences which they present are due entirely to differences of climate and soil. The Celtis of Indiana is a tall, handsome tree of regular form and rapid growth, having long and slender branches. The dark purple fruit ripens and falls in August.[2] As it occurs on the banks of the Merrimack, it is a low tree, with dense bushy top and stout trunk, often spreading at the base in an extraordinary manner, as if to anchor itself more

[1] Trees of North America, Vol. I., p. 367.

[2] August 18th. 1871, I examined some very fine trees of this species at Indianapolis, in the grounds of Mr. Ingram Fletcher. These were lofty trees, the first branches being at a great height from the ground. The fruit had at that time nearly all ripened and fallen.

firmly. The branches are flattened, distorted and covered with irregular knobs. The fruit does not ripen till late in autumn, and often remains on the trees till April or May of the next year.[1]

In fact the tree as it grows in Massachusetts differs from the western variety very much as the Beech and Yellow Birch of high mountain tops in New England, differ from the same species in fertile and sheltered valleys. The dense, bushy character of the top is produced by an annual "*heading in*" through the frosts of every winter, by which the buds on the ends of the slender twigs of the previous summer's growth are generally killed.

In nearly all descriptions of this tree which I have seen, the color of the wood is incorrectly stated. When properly seasoned and again cut and smoothed *after seasoning*, it is of a bright straw color, and very handsome. If cut while green, the surface, on drying, assumes a dark, greenish brown color, from some chemical change that takes place in the sap. Nuttall says of the European species, "Next to ebony and box it surpasses all others in durability, strength and beauty. It is esteemed for works of sculpture, for it never contracts nor cracks." This description will apply equally well to the American species as it grows in Massachusetts.

Mr. Russell of Providence, who was present, read from his his note-book some further illustrations of this subject. He also gave the following measurements of a remarkable sassafras tree at Cranston, R. I.: circumference at ground, 14 ft. 2 in.; at 2 ft. from the ground, 11 ft. 10½ in., from which point the circumference hardly diminishes to the height of the branches, 11 ft. from the ground. The height of the tree is 49½ ft.

The following article was added to Section IV of the By-Laws.

Article 3. Members who are absent from New England during the whole year, commencing on the first day of October, shall be exempt from the annual assessment for such year, provided that they givenotice of their intended absence to the Secretary.

[1] A very minute and accurate description of the species as it occurs in this State, with a plate representing a fine specimen now standing in Lowell, may be found in the new edition of the work of Mr. Emerson referred to above.

January 19, 1876.

The President, Mr. T. T. Bouvé, in the chair. Fifty persons present.

The President exhibited a fine series of cut and polished Porphyries from the vicinity of Boston, and read the following paper: —

On the Origin of Porphyry. By Thomas T. Bouvé.

My object in obtaining and in bringing together the specimens before me, has not been alone to show how rich our neighborhood is in rocks that may prove to be of great economic value in the industries of the future, but also to express some views upon their origin, which I have reason to believe will not receive the assent of all the geologists who have made them a study. My remarks will apply not only to the true Felsite Porphyries, such as have a compact feldspar base with included crystals of feldspar, but also to such as are generally of like composition and character, but do not contain imbedded crystals, or, if they do, the crystals are very obscure. All these rocks, the true porphyries and the other felsites, vary considerably in composition as well as in appearance, some containing a much larger per centage of silex than others; but essentially they are of the same general character, and all or nearly all found in our vicinity have undoubtedly the same origin.

Until within a comparatively recent period, all porphyries and all such rocks as I have referred to were regarded as of igneous eruptive character, and some of the text books now in use, as for instance Van Cotta's "Rocks Classified and Described" in the translated edition of 1866, include them among the Igneous Plutonic rocks, and no idea is expressed that any of them may be of metamorphic character. Hitchcock, however, in treating of the lithological character of the felsites of our State, in his great work on the Geology of Massachusetts, published more than thirty years ago, says, "It seems to me that in the present state of geological science, one may take it for granted that compact feldspar has been once melted, but *what* was the original rock from which it was produced?" In saying this he clearly did not mean that like lava, it was melted far beneath the present surface and brought to it by eruptive action, but that it was a rock derived from another by metamorphic action on the surface, changed by heat and other agencies from its original character to such as it now presents. In referring to Hitchcock's work I will say that there are now no more instructive views presented upon the porphyries and sienites of Massachusetts than can be found in its pages, notwithstanding the lapse of a third of a century since it was written, and the attention that has been given to these classes of rocks by eminent geologists.

I may be pardoned now if I refer to my own conclusions of many years past. I had been in the habit of examining as closely as possible the specimens of the red compact feldspar, *the Felsite* of Hingham, and though this presented itself to me of quite homogeneous structure, I came to regard it as derived from a source, the announcement of which seemed to me at the time too absurd to make. At a meeting however, of the Boston Society of Natural History, on April 2, 1862, I ventured to ask Dr. Jackson if he had observed evidence of metamorphic action in the conglomerate rocks of our neighborhood, stating that I had noticed by the waysides of Hingham, a blood red rock resembling red jasper, which I had suspected to be altered conglomerate, though I had not until then discovered anything of a pebbly or slaty characte in it, but had just found a locality where its derivation from the conglomerate could be traced.

This view of the origin of our felsite rocks was not, I think, regarded with much favor, and the subject was not apparently considered by observers until some years after. In 1870 Dr. Hunt presented a paper before the Boston Society of Natural History, in which he considered the rocks found in the vicinity of Boston, as embraced in three classes, viz :—

1. Crystalline stratified rocks.
2. Eruptive granites.
3. Unaltered slates, sandstones and conglomerates.

The first class, the crystalline stratified rocks, he again subdivided lithologically, making one division to consist of the felsite porphyries with the associated non-porphyritic jasper-like varieties, and the other of the epidotic, chloritic rocks, including the serpentines and amygdaloids. These two divisions he regarded as forming parts of one great, ancient, crystalline series of rocks which could be traced from Newport to the Bay of Fundy. In the discussion that followed the reading of Dr. Hunt's paper, Professor Niles distinctly stated that he had traced in Dedham the conglomerate until it passed into porphyry. He had noticed the effects of metamorphism where dikes occurred, and he believed that many of our porphyritic rocks were formed from the conglomerate. These views I sustained by referring to my own observations, expressing myself as satisfied that the porphyries of our vicinity, as well as the amygdaloids, were altered conglomerates.

Dr. Hunt closed the discussion by saying he was confident that at Marblehead these rocks were not altered conglomerates. They were derived rocks, but from the primitive parent rock on which they rested.

As Dr. Hunt has recently said that he should take issue with me upon the point, that the porphyries of Marblehead were derived from the conglomerate, I presume he has not altered his opinions in respect to any of the felsites of our neighborhood. I refer particularly to Dr. Hunt's expressions because of the very great respect that I have for his views, based as they are upon extended observation and a more thorough knowledge of the chemistry of rocks, and of rock formations than many can attain. They could not but have some influence in leading me to distrust my own conclusions without further examination. But such examination having only confirmed my original thoughts, I have sought to bring before you such evidence as hand specimens may exhibit. I have therefore brought here, not only specimens illustrating the variety and beauty of our porphyries, but such as may be serviceable in showing their origin. [A fine series of specimens was then exhibited.]

In conclusion, I wish not only to re-express my belief in the derivation of these felsites from conglomerates, but to go one step further, and include among the rocks having the same origin, some at least of the underlying sienites. I know that chemical questions can be asked that may not be easily answered, discountenancing this view, such as were asked by Dr. C. T. Jackson, at a meeting of the Society in December, 1869, who inquired, when Professor Shaler expressed the opinion that the sienites of our vicinity were of sedimentary origin, how the sienite was made, what sediments were so strangely metamorphosed into a crystalline salt like feldspar, and where did the rock get its potash and soda? Possibly if we knew more of the aqueous menstruum that permeated all these rocks when they were metamorphosed, these questions might be satisfactorily answered. That some of our sienitic rocks exhibit conglomerate structure, will not be denied after the very instructive instances cited by Hitchcock. But I refrain from expressing more on this point, simply because my own observations in the field have been so limited, but will ask if the reputed succession of our rock deposits is not itself very suggestive.

Conglomerate.

Compact Feldspar, gradually passing into Porphyry.

Porphyry, gradually passing into a rock intermediate between Porphyry and Sienite.

Rock intermediate between Porphyry and Sienite.

Sienite.

Now if this gives the true succession of our rocks, and I believe it does from the observations of others and not from my own, I ask if it be not a fair inference, that the causes that led to the changes in the higher portions of the series, affected all, only to a much greater degree the lower; that the heat and aqueous menstruum that softened and partly changed some of the conglomerates of the upper portion forming the felsite conglomerate, as it may be called, represented by the large specimen exhibited, and which melted the succeeding strata so as to produce first felsites without crystals, and below these the true porphyries, may not also by its greater intensity so thoroughly have melted down still lower strata of sedimentary rocks, (conglomerates and slates perhaps), as to entirely resolve them into their original elements, recrystallize them and thus have formed sienites, some of which may have even subsequently played the role of eruptive rocks; for it by no means follows that because a rock has been sedimentary that it may not also have become likewise eruptive by being forced upward when in a semi-fluid state.

Prof. A. Hyatt made some remarks in support of the theory advanced by Mr. Bouvé, and exhibited a map of Marblehead Neck, made some years back by the aid of the Plane Table Map of the United States Coast Survey, and also largely from observations made by the class of 1871, of the Mass. Institute of Technology.

The outlines of the porphyritic, granitoid, and micaceous rocks were pointed out, and the first named rocks more particularly described. The porphyries are the underlying rocks and occupy the greater part of the Neck, the southern shore only and an area to the north, of a few acres, being occupied by the micaceous rocks referred to above. Both these and the porphyritic rocks are overlaid by patches of coarse granite containing flesh-colored feldspar. The precise derivation of the granites could not be determined. When the map was made I supposed them to be volcanic products, and thought they had been derived from the same source as the vein rocks penetrating the Salem syenites. This conclusion, however, is untenable. The Salem syenites, which are so well known from their peculiar lithological characteristics, occupy a space of about fifteen square miles in the townships of Marblehead, Salem, and Swampscot. The whole of this series of rocks has been completely shattered by extensive eruptions from below. This is not only the most remarkable characteristic of the surface, as long since noticed by Professor Hitchcock, but is particularly observable along the cliff exposures of the shore lines; some of these, where the walls are perpendicular, show the original rocky mass split up into angular fragments from the size of a man's hat to those which are many yards in diameter. The fragments have not been injured by their violent separation, and if the veinstone could be withdrawn they would fit together with the most perfect accuracy. The veins are filled with rock, which in some places, is a compact red feldspar, and in others of a syenitic or granitic character, varying greatly in color and aspect.

The Salem syenites are crystalline throughout. There, are, however, indications that they may have been originally stratified deposits, though this conclusion must at present be considered very doubtful, and is merely mentioned in order to attract attention to this point. It has become evident to me that these Salem syenites are older than the adjacent porphyries and mica slates, and therefore that their veinstones have no relation in point of age and cannot have been the source from which the somewhat similar overlying granites of Marblehead and Beverly were derived. In fact, so far as my observations go, the conclusion appears to be unavoidable that the Salem syenites are remnants of a much older series of rocks than those to which the porphyries belong. Their characteristics are in every way distinct from the adjoining granites of Beverly, Gloucester, and Peabody, and the veinstones by which they are literally reticulated, do not extend upward through any of these or of the intermediate rocks, the porphyries and the mica schists of Marblehead. These last have been described as Huronian by Dr. Hunt, and so mapped by Prof. C. H. Hitchcock, but whether the Salem syenites belong properly to the next oldest system of Hunt's series or to the Laurentian, seems at present doubtful. This matter, however, as well as the subject of the chemical changes of the porphyries, will, I hope, be fully investigated by one of the Assistants in the Society's Museum, Mr. W. O. Crosby, and fully reported upon at some future time.

The porphyries appear to overlie the Salem syenites unconformably, and together with them are cut by at least two series of dioritic dykes, one running nearly north and south, and the other in a north-westerly and south-easterly direction, if indeed any system can be eliminated from the confused lines, which intersect each other in every direction on the surface. The porphyries, though varying greatly in aspect and in composition, are nevertheless but one formation, and derived from a vast conglomerate which appears in Lynn, Saugus, and Marblehead, and is reported to occur under the granites on the Beverly shore. The originally conglomerate nature of the entire deposit is inferred by extensive observations made by myself at Marblehead Neck, and by my assistant, Mr. W. O. Crosby, in Saugus, and the general identity of the purely crystalline porphyries of Lynn with those of Marblehead Neck, which are undoubtedly merely altered conglomerates. In some localities it is possible to study the various phases of the changes which may take place in the original conglomerate within the circuit of a few yards. Thus at one point on the ocean side of Marblehead Neck, the variegated conglomerate is altered to compact light colored felsite in one direction, in another becomes a dark colored porphyry with crystals of feldspar.

The change into the felsite is the most instructive, since here it is possible to trace the included pebble of dark colored, banded porphyry through all stages until it becomes a mere spot in the light colored matrix. During this change the pebble disappears by some process by which the structure is altered from without, the centre being the last point to lose its distinctive coloring or structure. This, and the unaltered form of the pebbles or masses, would appear to militate against the supposition that such a series of changes could only take place in a plastic or semi-fluid mass. But whether this was the case or not, and whatever the condition may have been, the fact seems to me unquestionable, after a review of this locality, that both a felsite and a true porphyry were formed out of a conglomerate, without any perceptible change having been made in the form of the contained pebbles. This is shown by some of the masses of the truly crystalline porphyry in which the pebbles have entirely disappeared in fractured surfaces, but show the outlines of their uncompressed forms upon the external weathered faces.

That the conglomerate porphyries cannot have been derived from the adjacent masses of banded and crystalline porphyries is inferred from the fact that the materials of the conglomerate are not identical. The pebbles contained in them are evidently derived from some older porphyries, and are quite distinct. Besides this, the traces of pebbles may be seen upon the weathered surfaces of the crystalline porphyries and felsites, and their transformations traced back to their original condition in the conglomerate in many localities.

The change of the pebbles into more or less lenticular masses, streaks, or bands, in the formation of the banded porphyries, is also very interesting. In this case the re-arrangement of the conglomerate, itself recomposed from older banded porphyries, takes place in a similar manner, but with certain distinctive characteristics. The material of the pebble is seen to be re-arranged, as it were, by the action of the matrix, into alternate bands of dark colored porphyry and white feldspar, marked here and there with imperfect crystals, the remnants of the centres of pebbles which have otherwise entirely disappeared. This re-arrangement proceeds from without, so that the pebble eventually becomes a lenticular mass arranged in alternate laminæ. This would seem to be the direct product of pressure upon the mass, which would naturally produce the lenticular form, and lead, especially if a moderate amount of heat were applied, to the production of bands of feldspar.

But if we examine the form which the laminæ of the coarse, pebbly matrix assume during deposition, we find that this lenticular form can be explained without bringing in the aid of pressure. These layers can be traced in many specimens. They are concave around the bases of the larger pebbles, straight or horizontal only at the middle part or zone around the centre, and become decidedly convex as they are heaped up on the upper half of the inclosed mass. The changes which take place first affect the lowermost and uppermost layers of the matrix, converting them into bands of feldspar and dark amorphous porphyry. These form a lenticular figure surrounding the pebble and the zone of intermediate horizontal layers, exactly as the lines of the eyelids surround the ball of the eye, supposing the corners of that organ to be filled with solid matter representing the horizontal layers. The changes in the majority of cases follow this pattern, so that the included pebble becomes reduced much faster in its vertical than its horizontal diameter, thus assuming a more elliptical and flatter form. The whole series of bands, which are thus seen to arise from above and below simultaneously, approximate more and more to a horizontal line in approaching the centre of each pebble until they actually do meet on one common level.

An infinite number of pebbles arranged with the longer axes in the planes of stratification, and undergoing such changes as these just described, would, by the intersection of their laminæ, form the more or less concentric or continuous and irregular bands which are to be found in what are called banded porphyries.

Another form of porphyry is also found on the Neck in which the pebbles seem to be absolutely flattened out, and then to fuse or run together at their extremities, forming dark continuous streaks or bands. The precise mode of the formation of this kind I did not succeed in following out, and in fact attempted, with regard to the others, nothing more than what could be accomplished by the most direct visual observations unassisted by chemical analyses. Nevertheless some curious facts can be observed in the merely mechanical phenomena attending these changes. It is exceedingly interesting to note that so great changes, as those described, could take place, and in a mass which must have been sufficiently plastic to permit of a continuous chemical reaction between the elements of the pebbles and those of the surrounding matrix, and yet not so plastic as to alter the contour of the pebbles. Also, that different kinds of rock, felsites, crystalline and banded porphyries, were produced essentially from the same conglomerate, but that in all of these, while the chemical and physical changes in the pebbles differed, the general facts remained, that in all cases the loose materials of the matrix exhibited the metamorphosis first, and the pebbles more slowly, the changes in the latter proceeding concentrically always from without inward. This would seem to indicate that the plasticity of the matrix, if it was plastic, communicated itself very slowly, if at all, to the contained pebbles.

Mr. L. S. Burbank made some remarks on the Conglomerate of Harvard, Mass.

This formation is of very limited extent, covering an area of about two miles in length by four or five hundred feet in width. The conglomerate is associated with a soft argillaceous and chloritic slate, which was formerly quarried and used for gravestones.

The beds of slate and conglomerate are interstratified, and coincide in strike and dip with nearly vertical strata of crystalline gneiss in which they are enclosed. The pebbles of the unaltered portion of the conglomerate consist almost entirely of a gray quartzite. None of these pebbles can have been derived from the rocks now existing in the immediate vicinity. These conglomerates and slates appear to form part of a continuous series with the enclosing strata of granitoid gneiss.

The series of specimens here exhibited shows a gradual transition from a nearly unaltered conglomerate to a crystalline gneissoid rock. Remarkable examples of flattened and curved pebbles are found in the conglomerate. In some cases the pebbles are so much elongated and curved as to give an agate like appearance to the surface of the rock, as seen in the specimens shown. In many of the larger pebbles there appears a laminated structure which was doubtless produced by the same force which changed their external forms.

The relation of these mechanically formed sediments to the adjacent crystalline rocks will be discussed more at length in a future paper.

Article IV of the Constitution was amended to read as follows: —

"Resident Members only shall be entitled to vote, to hold office, or to transact business; Corresponding and Honorary Members and Patrons may attend the meetings and take part in the scientific discussions of the Society; they may, however, on application, be transferred to the list of Resident Members, by a majority vote of the Council."

February 2, 1876.

The President, Mr. T. T. Bouvé, in the chair. Fourteen persons present.

The following paper was read: —

The Affinity of the Mollusca and Molluscoida.
By W. K. Brooks, Ph.D.

During last August and September I enjoyed, through the kindness of Mr. Agassiz, an opportunity of studying the development of several of our more common marine Gasteropoda; and the results reached seem to point to the conclusion, which I believe has never been pointed out, that although the Gasteropoda are much more specialized and highly evolved than the Lamellibranchs, nearly all their organs, excepting those of locomotion and relation, conform much more closely to the embryonic type than do the same organs in an adult Lamellibranch. The latter group must therefore be regarded as a side branch from the main stem, of which the Gasteropoda are a much more direct continuation.

I have already shown (Proc. Amer. Association, 1875) that the embryonic shell of Anodonta is, at first, a cup covering what is to become the dorsal surface of the embryo, and is therefore homologous with the shell of a Gasteropod. This cup or hood soon folds down on to the sides of the embryo, precisely as described in Dentalium by Lacaze-Duthiers, and at a very early period splits along the dorsal median line and becomes separated into the two halves of a bivalve shell, which are thus shown to be together the homologue of the shell of a Gasteropod exclusive of the operculum, which, as Selenka has shown in his "Entwickelung von Tergipes claviger," is formed by a split which extends across the long axis of the body, and therefore at right angles to that which, in Anodonta, gives rise to the two valves. The valves of an adult lamellibranchiate shell are a specialization of the embryonic shell; are bilateral in origin, and together represent the dorsal or haemal cup or shell of a Gasteropod, a Polyzoon, or a Brachiopod; while the ventral or neural operculum of a Gasteropod corresponds to the neural valve of a Brachiopod or the lid of a cheilostomatous Polyzoon, and is wanting in the Lamellibranchs.

The digestive organs of an adult Lamellibranch, although they are very much less specialized than those of a Gasteropod, seem to be much more widely removed from the embryonic type. The stomach of the Veliger of Astyris, like that of a Polyzoon, is divided by a constriction into two chambers. (Compare also the figure of the embryo of the Pteropod, *Carolinia tridentata* by H. Fol, and that of Limnæa by Rabl.) In the embryo of Mytilus we have, according to Lacaze-Duthiers, a similar stomach, and in the adult of Yoldia we have the same a little modified; here the anterior portion of the stomach receives the bile-tubes, and the posterior portion is prolonged so as to form a conical, somewhat twisted, intestine-like pouch, from the bottom of which the small intestine originates. In

Venus this peculiarity is much more marked; the posterior chamber is now tubular, and sharply separated from the true stomach, which represents the anterior half of the embryonic stomach. The tube is somewhat convoluted, and is imperfectly divided by a longitudinal fold of the inner wall into two parallel chambers, of which the anterior is the true intestinal cavity, while the posterior contains the crystaline style. In Cardium we find the process of differentiation carried a step farther. The partition, which in Venus is imperfect, here extends entirely across the tube, so that the cavity of the sheath of the style is completely shut off from that of the large intestine, although the two are still in contact, and are contained within the same outer wall. Solen will answer as an illustration of the next step in the process of differentiation. Here the large intestine is not united to the sheath of the style, although the former is nearly straight, and parallel to, as well as near the latter. In such forms as Mya the large intestine is entirely independent of the sheath of the style, and its large semicircular convolutions begin at the point where it joins the stomach. This series seems to show that the stomach of a Lamellibranch is homologous with only the anterior half of that of the embryo, or of a Gasteropod, while the large intestine and sheath of the style are together a very peculiar modification of the posterior portion.

In the prosobranchiate Gasteropoda, as in the Lamellibranchs, the gill is formed as a series of tentacular prolongations into the mantle chamber; these increase in number, and at last form a broad sheet, which is well shown beneath the transparent shell of Crepidula during the later "Veliger" and the early "Gasteropod" stages. In the Gasteropoda these tentacles remain free from each other during the whole life, and the water circulates over and around them; while in the Lamellibranchs they become so bent upon themselves and united to each other that the gill-tubes are formed, and the water is driven into and through these, to be discharged into the cloaca, which is a special chamber, peculiar to the Lamellibranchs. In such a form as Mytilus, where the union between the tentacles is somewhat imperfect, we have what appears to be an intermediate stage between the perfect lamella of Mya or Unio and the separate tentacles of a Gasteropod. The gills of a Lamellibranch are therefore, like the shell and the digestive organs, a specialized form of the embryonic type, which is pretty closely adhered to in the adult Gasteropod.

These facts must not be regarded as showing that the Lamellibranchs are higher than or derived directly from the Gasteropods, for any such conclusion is rendered impossible by the lack in the latter group of such peculiarities as the lingual ribbon, a centralized and highly evolved nervous system, and accessory organs of reproduction. Although it is true that these features might have been lost through adaptation to a sedentary life, their entire absence at all stages of growth, throughout the whole class, would seem to indicate that they never existed; so we cannot derive these animals directly from the Gasteropoda, but must regard them as an offshoot from a form of which the Gasteropods are the highly developed linear or nearly linear descendants. If this conclusion is accepted it is plain that all attempts to trace the phylogeny of the higher Mollusca through the Lamellibranchs to the Molluscoida, must be erroneous and useless.

The history of the discussion of the affinities of the Mollusca is an almost unbroken record of generalizations based upon imperfect knowledge and erroneous conceptions, and so many arrangements of the group have been proposed, accepted for a time, and then shown to be unnatural, that it is not at all strange that many naturalists should now call in question the existence of any real affinity between the higher and the lower classes. As long as the attention of the investigator was confined to the study of shells, there seemed to be no difficulty in connecting the Lamellibranchs with the Brachiopods through such forms as Anomia; and although the slightest anatomical knowledge is sufficient to show that the resemblance between these forms is entirely superficial and without scientific value, this conception had been so generally accepted and so firmly established that the confirmation by embryology of the results reached through anatomical research, has scarcely been able to thoroughly exterminate it.

This view has been replaced by another which is not open to the charge of superficiality, since it is based upon a thorough knowledge of adult structure, and its weakness is shown only when it is tested by embryology. The clearest and most forcible statement of this view is that given by Allman in his "Fresh-water Polyzoa." According to Allman the Tunicata are intermediate between the Polyzoa below and the Lamellibranchs above. The branchial sac of a Tunicate represents the permanently retracted tentacular crown of a hippocrepian Polyzoon; the tentacles form the horizontal bars of the sac, and uniting to each other at intervals inclose the branchial slits. Although Allman's figures are necessarily diagrams, no organ is exaggerated or suppressed for the purpose of making the likeness more forcible; they are very accurate and faithful representations of the animals, and show the closest similarity between these two forms; the position, structure and connections of almost every organ of the one being duplicated in the other. An almost equally perfect comparison may be made between a Tunicate and a Lamellibranch, but the recent great additions to our knowledge of the embryology of the Tunicata seem to show, with absolute conclusiveness, that we here have nothing but a very perfect and striking adult resemblance, reached in each of the groups in a different way and therefore without homological signification. Whatever view of the vertebrate affinity of the Tunicata we may incline to, we must recognize the fact that the branchial sac is morphologically part of the digestive tract, and in no sense whatever a lophophore or a tentacular gill. Moreover we should expect, according to all analogy, to find the affinity to other groups most clearly shown in the low or embryonic forms, but Appendicularia presents none of the peculiarities upon which the comparison is based. As Ray Lankaster has lately referred to Allman's homology in a way which seems to imply that he still accepts it, I will repeat more briefly my reasons for rejecting it. These are : first, that the development of the Tunicate shows that the resemblance is not due to community of origin, but is reached in different ways : and secondly, that the adult Lamellibranchs are a specialization of the embryonic type and therefore cannot lie in the direct line connecting the Molluscoida with the Mollusca. Allman himself seems to have seen the force of the first objection, for in a much later paper (1869), he advances the view that the Polyzoa are connected, through Rhabdopleura, with the Lamellibranchs. His studies of this genus were made upon alcoholic specimens; and Sars, who enjoyed the superior advantages afforded by an abundance of living specimens, has shown that Allman was mistaken in regard to almost every one of the points upon which he attempted to establish the supposed relationship.

These are only a few of the arrangements of the Mollusca which have been proposed, and the fact that, of the three selected, two are by Allman must not be regarded as the result of a wish to unfavorably criticize the work of this author. On the contrary the anatomical resemblances which he points out so clearly are worthy of the most thoughtful attention, and although they are not homological and do not indicate descent they are excellent illustrations of the independent origin of similar structures; a class of relations which has not yet been sufficiently allowed for in the speculations of the modern school of zoology, but which seems destined to form, at some future time, an important element in the theory of the evolution of life. The superiority of the conceptions of Allman becomes evident as soon as we contrast them with many which have been advanced; for example, the comparison advocated by a very distinguished naturalist and embryologist between the foot of a Lamallibranch, the tail of Appendicularia, and the placenta of Salpa.

We come now to the question : if our present knowledge of the embryology of the Mollusca and Molluscoida disproves all the old ideas of their affinity, does it present any thing to replace them?

Most of the Gasteropoda are known to pass through a free, locomotive "Veliger" stage. The veligers of different Gasteropods differ considerably in form; and in some the embryo, at this stage, is much less specialized than in others; but, omitting the complications introduced as adaptations to a spiral shell, the veliger of such a marine Gasteropod as Astyris may be regarded as presenting the typical form. A veliger may be described as a free-swimming, bilaterally symmetrical embryo, without a true heart or vascular system, or branchiæ, with the mouth and anus near each other on the median line. The digestive organs are suspended in the body cavity, and attached to the body-wall at the two external apertures, and by the various muscles. The foot is situated between these two openings; and the pedal ganglia, which are in most veligers the first ganglia to appear, are developed in the region of the foot; that is, between the mouth and the anus. The foot is generally supplied with a bunch of setæ, which are apparently sensory in function. The animal is inclosed in a shell composed of two portions; a large ventral cup, and a neural or pedal operculum, which is united to the anal margin of the cup at the earliest stages, and subsequently becomes separated from it. This shell and lid are found in the embryos of those forms where the adult is without an operculum, as Crepidula, as well as in those where the adult is destitute of a shell, as the Nudibranchs.

The most characteristic peculiarity of the veliger is the *velum.* This is a large, bilaterally symmetrical circlet of cilia, developed from the cephalic region of the embryo, and supported, at some distance from the body, by a transparent double-walled veil, the cavity of which is irregularly divided into large sinuses, in free communication with the body-cavity. The animal swims, usually near the surface of the ocean, by means of the long cilia of the velum, which would seem to perform the function of a respiratory organ as well, for the fluid which fills the body-cavity is driven into and out of the sinuses of the velum by the retraction and expansion of this structure; in most veligers this circulation seems to be aided by the rythmical contraction of the muscular fibres which bind the foot to the œsophagus. The mouth is not within the circlet of large locomotive cilia, but immediately behind it, and a ring or band of smaller cilia passes from the anterior margin of the mouth entirely around the velum, on its lower surface, and therefore outside the circlet of locomotive cilia. This second circlet seems adapted to convey food to the mouth, but there are no direct observations upon this point. The velum and the foot are retracted into the shell by the action of a pair of long muscles which pass from the sides of the œsophagus and region of the foot to the bottom of the ventral shell, and subsequently become the columellar muscle of the adult.

The veliger stage seems to be represented very perfectly in most of the marine Gasteropods, except some of those whose eggs are protected by strong cases, within which the early stages of development are passed. In some of these, as Purpura, there is a well marked but somewhat rudimentary veliger stage, and it is probably represented more or less faintly in all, although the embryo does not pass this period in free locomotive life, and accordingly has no need of swimming organs.

Although the marine Opisthobranchs pass through a perfect veliger stage, and are locomotive at this period, the fresh water Pulmonates undergo their embryonic development within the egg, and with them the velum is only faintly indicated, and it appears to be entirely wanting in the land Pulmonates whose young are not aquatic.

As regards the remaining classes of the Mollusca; the Scaphopods pass through an embryonic form which is easily recognized as a veliger, although it is not very highly developed. It would seem as if the Lamellibranchs, from their fixed or nearly fixed mode of life, had an especial need for a locomotive larval stage, but the veliger stage can hardly be detected in this group. Embryos of several of the marine Lamellibranchs have been described and figured as furnished with a circlet of cilia, and thus fitted for locomotion, but these embryos are so rudimentary in other respects, and so different from the highly specialized veligers of the Gasteropoda, that we cannot, with any safety, say that they represent this stage of development at all, although the fact that Anodonta has an unmistakable velum would seem to indicate that the Lamellibranchs, like the Gasteropods, are the descendants of a free-swimming veliger, and that the circlet of cilia described in the embryos of such forms as Cardium is also to be regarded as a rudiment of the same stage. It may be that the development of the young within the branchiæ or the mantle chamber in this class does away with the necessity for a locomotive embryo, but at present we know so little of the life history of the marine forms that we have very little ground for generalization. The imperfection of our present knowledge cannot, however, be fairly urged to restrain us from making as much use as possible of what knowledge we do possess, although we must constantly bear in mind that it introduces an element of uncertainty into all of our conclusions. This, of course, is true of all biological speculation at present, but no one would advocate the abandonment of all speculation and comparison until all of the facts of our science have been recorded and verified.

The embryo of Anodonta, at a very early stage, has, at the anterior end of the worm-like body, a simple band of cilia; as development progresses this is carried, by the formation of the mantle lobes, into the mantle cavity, and there increases in length, and the free ends bend towards each other and finally unite, thus forming a closed, bilaterally lobed circlet like that of the Gasteropods, except that it is not raised from the surface of the body, and its cilia are very short and are not used for locomotion. It is interesting to notice also that it is attached to the dorsal surface of the shell by two muscles like those of the veliger of a Gasteropod. In Anodonta these subsequently become the retractor muscles of the foot.

The thecosomatous Pteropoda present the veliger stage of development in a form as highly specialized as that of the marine Gasteropoda, and the embryos of the two do not differ at this time in any essential particular. The development of the gymnosomatous Pteropods on the contrary is entirely anomalous, and at present appears to be inexplicable on any theory of descent.

In the Cephalopoda, as so often happens in the higher representatives of a group, the indirect course of development has given place to the direct; the larval stages are usually entirely wanting, and the embryo shapes itself, from the beginning, into the form of the adult. In most Cephalopods there is no trace of a veliger stage, but its absence is what we should expect from the analogy of the higher forms of other groups.

The conclusion to be drawn from our present knowledge of the Mollusca, will appear, from this review, to be that all of them are to be traced back to a free-swimming ancestral form, of which the veliger embryo is the representative; this seems to be the only way in which we can account for its appearance in at least certain representatives of so many widely separated groups; and the presence of rudiments of it in such forms as Anodonta and the Pulmonates seems to indicate the same conclusion. We have seen that in many of the cases where it is wanting its absence can be reconciled with this theory, even with our present knowledge, and we may therefore hope that a more complete acquaintance with the embryology of the naked Pteropods will show that they are not an exception.

We come now to the interesting question: what are the affinities of this "Veliger" from which the true Mollusca are descended?

It is only necessary to glance at the side view of any fully developed veliger, such as Selenka's figure of Tergipes, in order to notice the resemblance to a Polyzoon, and more careful examination shows that the resemblance holds not only in the general plan but in detail. The velum corresponds to the lophophore in position and structure, and subserves, like this, the function of respiration, and probably that of ingestion as well. The heart is absent in both, and the fluid which fills the body cavity and bathes the digestive organs is kept in motion by the contraction of the various muscles of the body. The digestive organs are similar in form and also in their connections. The epistome with its ganglion answers to the foot and pedal ganglia, and in Rhabdopleura the epistome is functionally as well as morphologically a creeping disc. The shell and operculum answer to the cell and lid of a cheilostomatous Polyzoon, and the retractor muscles are clearly homologous. The most important differences seem to be that among the Polyzoa, the animals are fixed and multiply by budding; and that in all, the mouth, as well as the epistome, is within the circlet of the lophophore. (Rhabdopleura was described by Allman as an exception in this respect: Sars however has shown that although the tentacle-bearing portion comes to an end upon the sides of the foot, the line of cilia is continued entirely around it.) The lack of agreement between the positions occupied by the mouth and foot in the two forms seems to be the most serious objection which can be urged against the view here advocated. In answer to it we can only point out that in Dentalium the mouth is formed within the circlet, although the foot is outside it. It is not to be supposed, however, that the veliger can be traced back to any existing form of Polyzoon, or even to any Order of this Class. In some respects its affinities are with the Hippocrepia, in others they are with the Cheilostomata, and in still others they are with Rhabdopleura, and they therefore indicate that the common ancestral type of the Mollusca was, not a true Polyzoon, but simply a polyzoon-like form. A lack of agreement in points of detail is therefore no more than we should anticipate. In answer to the second objection, that the Polyzoa multiply by budding, we may refer to the well known law, that agamic vegetative multiplication is antagonistic to high evolution, and is accordingly replaced by true sexual reproduction in the higher forms of all classes of animals; as its presence, if it occurred in any of the true Mollusca, could not be regarded as proof of an affinity to the Polyzoa, its absence does not disprove such affinity. No one will attach much importance to the remaining objection, that the Polyzoa are fixed; in fact those which are developed from statoblasts are at first free and swim by means of the cilia of the lophophore.

The similarity between the Polyzoa and true Mollusca, in general plan of structure, has long been recognized, but the attempts to connect the two groups through the Lamellibranchs are so evidently incorrect that, led by the unquestionable affinity of the Polyzoa and Brachiopods to the Vermes, many zoologists are now inclined to separate these lower forms from the Mollusca proper. As soon as we recognize that the Lamellibranchs are not to be regarded as typical Mollusca, and that all of the latter are to be traced back to a "Veliger" all difficulty seems to disappear, and it becomes plain, not only that the Mollusca and Molluscoida are related, but that they are connected so closely, that the advisability of such a division is very doubtful. We also obtain, at the same time, an explanation of the worm-like early stages of the embryo, exhibited by so many of the true Mollusca. The belief, so firmly supported by nearly all zoologists a few years since, that the various branches of the animal kingdom are absolutely independent of each other, has been almost entirely overthrown by the accumulation of new facts, and the constantly increasing tendency to examine them in their bearing upon the theory of the evolution of life; and the union or junction of the Vermes and the Mollusca, in some manner, has already found a number of advocates.

Prof. Morse, by his investigations upon the anatomy and embryology of the Brachiopods, has shown that, if we consider this group by itself, it must be placed with the Annelids. His investigations also show, with equal clearness, that the Brachiopoda are closely related to the Polyzoa, and we must therefore regard them as united by the "Veliger" to the true Mollusca. If we accept the view that the molluscan and vermian stems are thus united, the question,—"Are the Brachiopods Worms or Molluscs?"—will be regarded as nothing but a verbal discussion; for this class forms the connecting link between the two groups, and any sharp line of demarcation does not exist.

We are now prepared to form a provisional phylogeny of the Mollusca, which may be stated as follows:

The Brachiopods are derived from the Vermes; and from the brachiopod stem, but from something very different from any known Brachiopod, the Polyzoa originated. From the polyzoon stem, but not from any known Polyzoon, we have the Veliger. The true molluscs have originated as several offshoots from this veliger stem. Of these the Scaphopods seem to be the least specialized, and in most respects nearest to the original proto-mollusc. The Pteropods are the representatives of another offshoot, to which the Cephalopods also seem to belong. The Gasteropods seem to represent several distinct branches. The Prosobranchiata and perhaps the Heteropods being the descendants of one; the Opisthobranchs and Pulmonates of another; and the Chitons of a third. From one of these, or perhaps from the branch now represented by Dentalium, the Lamellibranchs seem to have been derived at a very early period, and to have diverged considerably from the ancestral form, becoming degraded in certain respects and at the same time specialized in others.

In this scheme all reference to the Tunicata is omitted, since it will be conceded by all embryologists that, whatever the affinities of this group may be, they are certainly not with the molluscs.

I have already referred to one serious objection to the view here advocated; that is, that it fails to account for the remarkable embryonic forms of certain Pteropods. Huxley has advocated the view that the Pteropoda and Dentalium have an annelidian ancestry distinct from that of the remaining Mollusca. This view would help us to understand the remarkable larval form of such genera as Pneumodermon, and at first sight would seem to present a way of escape from our difficulty. It fails to account for the perfect agreement between the veligers of the thecosomatous Pteropods and the Gasteropods, however, and thus introduces a difficulty at least as great as that which it removes. At present the safest plan seems to be that of waiting for more knowledge, bearing in mind the existence of this at present insoluble difficulty.

Mr. S. H. Scudder gave an account of the mode in which the hind wings of Orthoptera, and especially of Cockroaches and Earwigs, are folded in repose, showing the gradual steps from a simple to a very complex duplicature, which these insects present.

Mr. Bouvé exhibited three specimens of rock, lately obtained from a ledge at Hyde Park within eight feet of each other, and pointed out the gradation from true conglomerate to true porphyritic structure, which they exhibited.

Dr. W. K. Brooks exhibited a cast of a viviparous fish (Embiotica) from California, showing the young *in situ*, and also a cast of the monstrous form of the human uterus, known as "*Uterus bicornis*." Both casts were the work of Dr. Nardyz of Cleveland, in whose name Dr. Brooks presented them to the Society's Museum. The thanks of the Society were voted for these gifts, and also to Messrs. Brooks & Torrey, of Boston, for grinding a number of porphyries for the collection.

February 16, 1876.

The President, Mr. T. T. Bouvé, in the chair. Forty-three persons present.

Dr. W. G. Farlow made some remarks on the nature and mode of growth of the black knot which attacks plum and cherry trees.

The knot is not of insect origin, as some have supposed, but is due to a fungus described by Schweinitz under the name of *Sphœria mor-*

bosa. The spores of this fungus ripen in mid-winter. The disease is confined to America, and was communicated to cultivated cherries and plums from our wild species of Prunus, viz., *P. virginiana*, the choke cherry, *P. pennsylvanica*, the bird cherry, and *P. americana*, the wild plum. The remedy consists in cutting off the branches two or three inches below the knots. The branches removed should be burned, and it is also desirable to prevent the increase of the disease by destroying the wild choke cherries which, in the region of Boston, are covered with black knots.

March 1, 1876.

Vice President, Mr. John Cummings, in the chair. Forty persons present.

The following paper was read :—

Descriptions of New North American Noctuidæ.
By H. K. Morrison.

Agrotis perpolita nov. sp.

Closely allied to *A. velleripennis* Grote, but at once distinguished by the shorter serrations of the antennæ of the male.

Anterior wings black, with a fine purple brown reflection; the color is uniform and the ordinary markings are obsolete, except the concolorous reniform and orbicular spots, which are surrounded by five black annuli. Posterior wings blackish fuscous, with an ill defined terminal black line; fringe lighter, divided by a central dark line. Beneath blackish, base and central portion of both wings lighter; discal dot distinct, but the usual median line absent. Expanse, 39 mm.

Hab. Orono, Maine. Received from Prof. C. H. Fernald.

Agrotis Fauna nov. sp.

Allied to *A. messoria* Harris, but can be separated by the structure of the antennæ in the male; they are pubescent instead of serrate. Color grayish brown, not purely gray, all the lines and spots present, the orbicular spot elongate, hatchet-shaped, the space between it and the reniform spot blackish; median shade distinct; transverse lines as in *A. messoria.* Posterior wings uniformly gray, with discal dots. Beneath gray. Expanse, 37 mm.

Hab. Gaudaloup Island (250 miles off the coast of Lower California). Collected by Dr. Edw. Palmer; received through Mr. S. H. Scudder.

Agrotis Olivia nov. sp.

Allied to *A. specialis* Grote, separated by the slightly longer serrations of the male antennæ, the white instead of dark gray posterior wings, the whitish, disconcolorous, costal shade, and the gray instead of bright reddish brown ground color of the anterior wings; the ordinary spots open above into the costal shade; they are preceded and followed by black marks; claviform spot distinct, followed by a light oblique shade; subterminal line irregular; terminal space dark. Expanse, 36 mm.

Hab. Utah (T. L. Mead).

Agrotis comosa nov. sp.

Related to *A. fumalis* Grote, differing in the structure of the antennæ in the male; in *fumalis* the antennæ are distinctly serrate, each serration furnished with a tuft of short bristles; in *comosa*, the serrations are reduced to short knobs, each with a larger bunch of much longer bristles. Anterior wings yellowish-gray instead of gray; transverse lines as in *fumalis*, but the interior line is less strongly lobate; median shade distinct; reniform reduced spot to a black dot, orbicular apparently absent; subterminal line dentate and quite distinct. Posterior wings uniform gray. Expanse 38 mm.

Hab. Colorado (T. L. Mead).

Agrotis hero nov. sp.

Related to *collaris* and *baclinodis*, but separated from them by the unarmed fore tibiæ.

Collar black and disconcolorous above. Thorax concolorous with the anterior wings. Anterior wings crossed by two even, simple, dark brown lines, the first preceded, the second followed by a pale accompanying line; ordinary spots not very well defined, shaped as in *collaris*, the orbicular preceded by a black spot; median shade distinct, passing between the spots; subterminal space darker brown, subterminal line indefinite. Posterior wings uniform dark brownish gray, discal dots present. Beneath brownish gray, with discal dots and a common diffuse median line. Expanse, 32 mm.

Hab. Beverly, Mass. Mr. Edward Burgess.

Agrotis personata nov. sp.

♀. Related to *pitychrous* Grote. This species I have had in my collection for a long time, but I can not consider it a variety of its ally, of which I have a series of twenty to twenty-five specimens from Long Island (Israel Tepper) Chelsea Beach, Boston, Cape Cod, Hampton Beach, N. H., Owl's Head, Maine, etc., and it is found, so far as I know, only near the ocean; while *personata* comes from Central Illinois. The discovery of the male will settle the question of its identity.

Anterior wings dark gray, with all the markings present, but confused, irregular and pulverulent; costal, subterminal and anterior half of median space lighter than the ground; ordinary spots small, the space between them dark; median shade distinct; subterminal line very close to the exterior margin. Posterior wings dark gray, with white contrasting fringes. Beneath, the anterior wings are black with the costal light; the posterior wings white, with distinct discal dots and a regular conspicuous subterminal line. Expanse, 30 mm.

Hab. Illinois (Mr. G. M. Dodge).

Agrotis orthogonia nov. sp.

All the tibiæ spinose. Antennæ of the male strongly serrate. Middle of the second joint of palpi black, its outer edge and tip, as well as the third joint, light. Head and thorax gray. Anterior wings dark gray; all the markings well expressed; half-line followed by a white shade line; basal space lighter than the other portions of the wing; interior line forming a very long outward projection below the submedian vein, and another shorter one on the costa, the line is white and distinct, bordered with black on each side, between the submedian and subcostal veins it is straight, except one lobe below the median vein, to which the concolorous, black edged claviform spot is attached; subcostal median and submedian veins white, and contrasting; orbicular spot elliptical, with an outer black ring, within which appears a white annulus, enclosing the gray centre; reniform spot large and of the usual shape, the portion of its black annulus, beneath the median vein, separated and very distinct; exterior line rounded, formed of interspaced luniform marks, followed by a white shade line; subterminal space rather lighter than the median space, terminal space again dark; a series of partially effaced cuneiform marks, before the white subterminal line, which forms two short teeth on the second and third median branches. Posterior wings whitish at the base, with a black terminal band and contrasting white fringes. Beneath whitish, the centre of the median space dark, and the neighborhood of the median vein, on the anterior wings, clothed with long soft hair. Expanse, 34 mm.

Hab. Glencoe, Nebraska. Received from Mr. G. M. Dodge. (No. 66.)

The nearest ally of this fine species is the European *Agrotis vestigialis* Rott.

Segetia proxima nov. sp.

Eyes naked. Clothing of the head, collar, thorax and palpi coarse and mixed with scales; second joint of the palpi black. Abdomen wanting in the single specimen I have of the species. Anterior wings gray, with the lines all faint, confused and rivulous; interior line geminate, oblique, exterior very widely geminate, regularly rounded; orbicular spot reduced to a black dot, reniform dark gray, indistinct, surrounded by several white points; median shade present before the spot; subterminal line distinct, irregular, with a brown tinge, followed by a light line; a series of black dots, followed by a light line at the base of the fringe. Posterior wings whitish, translucent, with an irregular black border, extending up along the veinlets. Beneath, the median space of anterior wings is blackish; both the wings with yellowish costal borders, tinged with brown; the rest of the wings white; fringes yellow at the base. Expanse, 32 mm.

Hab. Texas.

Homoglaea nov. gen.

Eyes naked, with long lashes. Palpi short and weak. Head drawn in. Front smooth and thickly clothed. Antennæ in the male, with a double row of short, blunt serrations, each provided with a long yellow terminal tuft. Thorax stout, with the collar not separated, and indeed hardly distinguishable, smoothly but thickly clothed, and without tufts. Abdomen short and untufted. Wings shaped as in *Scopelosoma*. All the tibiæ smooth and unarmed, the femora clothed beneath with unusually long hair.

This genus is allied to *Scopelosoma*, from which it is separated by the formation of the antennæ.

Homoglaea hircina nov. sp.

Head, collar and thorax, dark purple gray. Anterior wings purple black; a light dot in the basal space; median lines light gray, simple, broad, even and distinct; ordinary spots concolorous, with brown annuli; veins light gray, particularly in the outer half of the median space; claviform spot absent; subterminal line tinged with brown, faint; the terminal and subterminal spaces concolorous. Posterior wings uniform, grayish fuscous, fringed with white; discal dots present. Beneath, the anterior wings are dark gray, with contrasting white and black atoms in the costal and apical spaces; posterior wings gray, with numerous black atoms and discal dots. Expanse, 35 mm.

Hab. Galena, Illinois. This fine species was received from Mr. Thomas E. Bean. (No. 137.)

Tæniocampa revicta nov. sp.

Eyes hairy. Palpi brown and disconcolorous. Head and thorax uniform, very light gray. Anterior wings of a slightly darker gray; the median lines dentate and very faint, the subterminal line clear black, very conspicuous, divided into short lines by the veins, obsolete before the costa and inner margin; ordinary spots large and concolorous, the orbicular open above and below, the reniform also imperfect, with a black spot in its base; both are surrounded by clear brown annuli, the tip of the claviform spot also of the same color. Posterior wings gray, with white fringes and black discal dots. Beneath, with discal dots and an interrupted common median line. Expanse, 35 mm.

Hab. Galena, Illinois. A single specimen taken by Mr. Thomas E. Bean. (No. 197.) The black subterminal line is the most important character of this insect.

Homoptera penna nov. sp.

This species is allied to *Homoptera galbanata* Morr., which Mr. Bean has captured in the same locality; it is separated from it by the partial obsolesence of the median undulate lines and by the presence on both wings of a very heavy continued black band following the exterior line, at a little distance.

This character will also separate it from all the species of the genus known to me; several of them have a more or less distinct black line in this position, but in none of them is it so broad, heavy, so evenly continued over both wings, and so strongly contrasting with the ground color which, in the new species, is light gray. Expanse, 40 mm.

Hab. Galena, Illinois. Received from Mr. T. E. Bean. (No 147.)

Mr. Alex. Agassiz gave an account of his recent studies on the affinities and homologies of the various groups of Echinoderms, and pointed out the relationship of these with the Cœlenterates.

Dr. H. Hagen read a paper calling attention to the dangers with which the presence of white ants in New England threatens us. The importance of a full recognition of this source of danger was strongly urged, and measures for lessening and removing it were suggested.

March 15, 1876.

The President, Mr. T. T. Bouvé in the chair. Forty-nine persons present.

The President read the following address:—

When, five years since, I became President of this Society, I did so with much misgiving, having great doubt of my ability to meet the reasonable expectations of those who had urged me to accept the exalted position that had been occupied and graced by such men as had preceded me, more especially as I was called upon to immediately succeed one so universally loved for his modest worth, so highly respected for his rare attainments, so distinguished for his devotion to, and his great accomplishments in, science, as was Dr. Jeffries Wyman. I could not but feel at the time that it might be far wiser for the Society to elect some one better known than myself in the scientific world, some one that would bring to it the prestige of a name renowned for successful labor in some of the branches of science, whose cultivation it is the object of our Society to foster; or at least some one who, free from business engagements and devoted to scientific work, might give a large portion of his time and thought to the interests of the Society. I myself proposed the names of one or two whom I thought might prove acceptable, but being over-ruled by others finally consented to allow my own to be used in nomination, the result of which has been my service in the high office to which I was elected for rather more than five years; whether to the great advantage of the Society or not, it becomes me to be silent. I have done the best I could for your interests, and shall be content with the judgment of those with whom I have been closely associated and whose opportunities have enabled them to see and to properly estimate what, with the kindly support and hearty co-operation of others, I have been able to accomplish for the benefit of the Society. I now propose to give some reasons why I felt not only willing but glad to assume the duties of the office of President, notwithstanding the misgivings before referred to, and why, too, I now as willingly and as gladly resign the position, and ask to be freed from its duties and its responsibilities. Before doing this, however, I will briefly review my connection with the Society, both because in my experience some reasons may be found for my action, and because some reminiscences of earlier days in the history of the Society may not be uninteresting to you.

I first became a member of the Society in 1834. At that time Dr. Benj. D. Greene was President of the Society, and among the active members whom I call to mind, that is (those who generally attended the meetings and took part in the proceedings), were Dr. Augustus A. Gould, Mr. Geo. B. Emerson, Dr. D. Humphreys Storer, Dr. Martin Gay, Dr. Amos Binney, Dr. Chas. T. Jackson, Dr. J. B. S. Jackson, Mr. Chas. K. Dillaway, Mr. Epes S. Dixwell, Dr. Walter Channing, Dr. A. A. Hayes, Dr. Jeffries Wyman, Mr. Thos. Bulfinch, Mr. Thos. A. Greene, Mr. C. C. Emerson, Dr. Samuel Cabot, Mr. Francis Alger, Mr. J. E. Teschemacher and myself. The meetings were held as now, twice each month, but always in the afternoon.

Dr. Gould was, perhaps, our best general naturalist, his acquaintance with the Invertebrata of our Coast being recognized as superior to that of any other observer; and he was a very good botanist. Of all the departments of natural history he knew something, and was interested in all. Dr. C. T. Jackson, Mr. Alger, Dr. Hayes and Mr. Teschemacher were mineralogists, and of these Dr. Jackson and Dr. Hayes were also good chemists. Dr. Jackson was likewise a geologist, but his knowledge of this science did not embrace much acquaintance with fossil remains. In truth, there was but little palæontological knowledge among us, and it is now almost ludicrous to recall the proceedings of those days when some unknown fossils were presented to the Society. The first object was to get, if possible, some clue to their character. To accomplish this the fossils in question were referred to some willing member, and as there was not great pre-eminence of knowledge on the part of any one respecting them, it made but little difference who was selected. I recollect well the instance of a series of the smaller forms of fossil corals being presented to the Society, and the interest excited thereby. One of our number, distinguished for his classical culture and excellent literary taste, was appointed to elucidate their character and enlighten our minds respecting them. When I mention that Parkinson's "Organic Remains of a Former World" was our principle source of palæontological knowledge, and that this was a work not owned by the Society, you may judge of the task imposed on one who certainly claimed no knowledge of fossils, however eminent he might be in Greek and Latin lore, in asking from him a report upon their character. Fortunately a recent article in the Am. Journal of Science, by Hildreth, enabled our classical brother to present quite an instructive report upon the forms referred to him.

From this some idea may be formed not only of our lack of knowledge in this department, but of our lack of means to obtain it. Everything except the will to learn, was wanting — books, teachers and collections, from all of which we now derive so much help.

One effect of our want of experience was the placing of specimens, sent to us from abroad, in drawers without proper regard to the importance of attaching to them any labels that had accompanied them, and the consequent mixing together of every thing we received, which led eventually to a considerable portion becoming scientifically worthless for lack of proper identification. Much that I have said of the want of knowledge and experience respecting palæontological specimens, might be said as well of those of other departments; or we should not have suffered one of the most valuable entomological collections in the United States to be utterly destroyed under our eyes by Anthreni, and the only fine specimen of a cougar ever received by us, and now much wanted for our New England collection, to be scattered to dust by moths. I speak more particularly of the palæontological collection because it is one with which I subsequently had the most to do.

At the time to which I refer, the Society occupied a large room in Tremont Street, over the Savings Bank, and as the building stood next north of the King's Chapel burying ground, the whole south side received light and made our room a very desirable one for the exhibition of our collection. We entered the room, which was long and narrow, by an end door next to Tremont Street, and at the farther part from the entrance, *i. e.*, at the east end, was placed a table about which we gathered at our meetings, a number of settees being there placed for our accommodation.

The meetings, as before stated, were in the afternoon, and were conducted, as now, with due formality; but, as now, the social element was not lacking, and perhaps manifested itself the more readily because of our fewer number, and of our close contiguity about the chair.

An instance of jocoseness may be not improperly mentioned, which may recall pleasantly the scene to some of the eldest among you.

One of our number, and one of the best of men, Dr. Martin Gay, a near and dear personal friend of mine, had, among numberless good traits, one not so commendable, that of being often tardy. One afternoon, just as we had got well into the proceedings, the door of our hall, quite distant from where we were sitting, was opened, upon which Dr. Storer, partially rising and looking back, that he might see the reason of the disturbance, turned to the President and quietly announced the arrival of the *late* Dr. Gay. The latter thus acquired the cognomen of the "late" Dr. Gay with many of us, long before the phrase became significant of a sad and great loss to our number.

On the left side of the hall, as you entered it, were upright cases, all, or nearly all, filled with the fine mineralogical cabinet of Dr. Jackson, and on the floor were table cases, two rows running lengthwise with the room, some containing fossils, but the larger portion devoted to the conchological collection belonging to the Society, which was then quite a good one, and under the care of Dr. Gould, who took great interest in it. It was then the custom of some of the Curators to be present on days of exhibition and to interest visitors by their explanations. This was especially the case with Dr. C. T. Jackson, who seldom failed to meet visitors and to gratify them by his talk upon minerals, and his interesting anecdotes concerning them. Dr. Gould, too, passed much time in this way, to the great advantage of his hearers and to the Society. My own studies at this period had been mainly in Mineralogy, but as I was somewhat interested in geological inquiries, I was asked to become a Curator; and the department of Geology was accordingly separated from that of Mineralogy, the fossils at the same time coming under my charge, as there was no separate department of Palæontology. I state all this to give some idea to many of you not acquainted with our early history, of the gradual development of our knowledge and of our modes of action in the immature youth of the great Society that now exerts such widespread influence in the community, and which is destined to still greater usefulness, if those who shall come after us will be faithful to the great responsibilities soon to be transmitted to them. Few of you, now having books at your command treating fully of every branch of Natural History; intercourse with men fully able to instruct in every department of science; collections of every character systematically arranged, that may be consulted; can have any idea of the great want felt by those of us in the days referred to, lacking all these, and also the means to acquire them. It seemed in my own department sometimes almost a hopeless task to undertake to make out a fossil species. I have worked days over one fossil only to find that no accessible work or collection would help me make out its specific character, and I have labored for years over our early collection of fossils in order to verify them, when weeks would have sufficed if the present means had existed for their study.

I will not weary you with a too full retrospect of the past. The records of the early days are full of encouragement for the laborers of the future. The influence of the Society was not by any means limited to the advantage of those who were members, or even to those who could visit its collections and listen to its speakers. At the period I have referred to, already some of its active members were in the field engaged in the great work suggested by the Society of making a Botanical and Zoological survey of the State, which resulted in the very able reports of Mr. Geo. B. Emerson, Dr. Thaddeus W. Harris, Dr. D. Humphreys Storer and Dr. Augustus A. Gould.

But a new era was to dawn upon science in our country by the advent of Agassiz and the establishment of the Museum of Comparative Zoology in Cambridge. Of the influence of the latter upon the well-being of our Society, there may at first have been some reasonable question, though not concerning the great value of that institution to science in general. Experience has, however, abundantly shown, and every day adds further testimony to the fact, that not only has the cause of science throughout our whole country been advanced by the establishment of that great Museum, but that this Society in particular has been, and is now, being benefitted by the culture which has there been given, to a degree beyond what can be readily estimated.

One of the most important events in the history of the Society, and one which led directly to its great development, was the interest excited in the mind of our great benefactor, Dr. Wm. J. Walker, in our work, mainly through the interest he first felt in Dr. Jeffries Wyman, whom he much loved and respected. When moved to take some action, he asked Dr. Wyman to bring some business man of the Society to him, and I was introduced as such, and as Treasurer. From that time Dr. Wyman and myself were frequently called in consultation with Dr. Walker, sometimes at Newport, sometimes in Boston or Cambridge, the result of all being the great donations which enabled us to build this Museum, and the magnificent endowment bequeathed to us, by which we have chiefly been able to do what we have since done as a Society to advance science and to further its culture in the community. Of course the Society had itself great need of experience in order to do its work in the best manner, and for want of this many mistakes were unavoidably made, greatly to our cost afterwards. I shall refer to but two, and to these only because of their great subsequent effects. One relates to the construction of our new building, the other to the arrangement of our collections. The first was in permitting the making of cases in all our principal rooms of a very defective character, costing many thousands of dollars, which we have recently been obliged to rebuild at nearly as much more cost in order to prevent the destruction of our collections, and the other was the placing of the collections of the several departments without regard to their relations with each other, from a lack of proper appreciation of the importance of arranging them in natural sequence, this being now recognized as of very great service from an educational point of view. I think I may truly say that in taking possession of our new apartments, the officers of the several departments only thought of securing good accommodations for the display of the particular collection of each without at all considering the relation which it might have to others adjoining. The result was, that however scientifically arranged may have been each department, there was no general arrangement of the whole. To Prof. Hyatt was due the suggestion of the importance of this, first expressed in his proposed plan of organization which was adopted for the guidance of the officers of the Society by a vote of the Council in July, 1870. He therein expressed his view in the following language: "The Museum of this Society is intended especially for the instruction of teachers, general students, and the public; therefore its collections should be arranged according to some easily understood and comprehensive plan, illustrating the general laws of natural science unencumbered by details. All the different departments should be connected as closely as possible, and form together a series of lessons in the structure of the earth and its constituent parts, and in the organization of the plants and animals living upon its surface."

The adoption of the plan then proposed by no means implied the belief that the Society could rearrange the collections of the different departments so as to bring them into the desired natural sequence, but only committed it to be governed by such general views whenever found practicable. In truth no one saw how it would be possible to do it. Even President Wyman, though fully recognizing the great importance of such general arrangement, expressed to me that he did not think such rearrangement practicable.

I now come to the time when by your suffrage I was elected President. After the brief review I have given of some of the events preceding, and a recognition on your part of my long experience in the Society, you will perhaps be the better able to appreciate the reasons which I will give why I felt willing and glad, as before expressed, to assume the duties of the office, and why I have been glad to retain it until the present time. I felt greatly indebted to the Society for the personal good it had been to me, enabling me through its means to acquire knowledge not otherwise within my reach, and I thought that I perhaps might be better able to serve its interests by accepting the Presidency than I otherwise could. I had to a certain extent been made the confidant of our great benefactor, Dr. Walker, and knew undoubtedly better than any one else, excepting Dr. Jeffries Wyman, all his wishes concerning the Society, wishes that I felt it to be my duty to have respected and followed as they deserved to be; none of them being otherwise than such as experience has since demonstrated to have been wise. His great interest in true scientific progress, his earnest desire that the great mass of the people should participate in the advantages of a higher culture impressed me strongly, and would have alone inclined me to take any position in the Society where I could exert an influence in leading it to action in harmony with his views. Furthermore, I had a strong and abiding belief that the Society might be made one of the most popular character, available for the instruction of all who should seek its aid, and even be a temptation to thousands of wayfarers, leading them to follow paths of progress they might not otherwise enter; and at the same time become one whose thoroughly scientific character and action should be recognized the world over. Scientific, I mean, in accordance with its aims; for I have always recognized that these should be very different from those of such institutions as the Museum of Comparative Zoology. Add to these reasons the assurance that was given me by all the active members, that my acceptance would certainly promote the good of the Society and further my wishes regarding its action, and you have my reasons for taking the position.

Since then all, or most of you know, the great changes that have been brought about, and the much that has been done towards accomplishing the ends then in view. By as economical management as possible, most of the cases throughout the building have been altered, so as now to be of the best character for the preservation of their contents, and this work will now go on to completion. Through much study on the part of the Custodian and other officers, and by great labor of many members of the Society extending through the years of my service as President, the great change so much desired and so necessary for our well being, has been, not without opposition, accomplished, and thus the strong wishes of all desiring the highest good of the Society have been realized, or soon will be. The collections of the several departments present now, "beginning with the minerals, a series of lessons in the structure of the earth and its constituent parts, and in the organization of the plants and animals living upon its surface." Moreover, there is, or will be soon, a separate New England collection for each, which fulfils a strong desire long entertained and advocated by me.

During my term of office there has been consummated, greatly to my satisfaction, a hearty co-operation with the Institute of Technology, by means of which we have both been able to accomplish more than we otherwise could have done for the advancement of the purposes for which we were instituted; the increase of science and of general knowledge among men.

Rejoicing that the objects referred to, and many others dear to my wishes, have been accomplished, or are in the fair way of being so, and with the full recognition on my part that no interest will now suffer by a change, but that, on the contrary, benefit may result,—thanking you gratefully that opportunity has been given me by your support, to further projects that I felt important for the welfare of the Society, I now cheerfully tender my resignation of the office of President, meaning, nevertheless, to serve your interests as devotedly in the future as I have endeavored to in the past.

There is one strong wish of my heart ungratified, one that I hoped might in some way be met whilst yet I remained an active member. That wish is, that *each* department might possess a fund for the care, proper use and preservation of its objects. With such funds there would always be a corps of workers in the Society whose services would be available for instruction, and thus the general objects of the Society be the better promoted. The great service rendered to the Society by the special funds now available for the Library, Prizes and the Molluscan Department, are suggestive of the much that might be accomplished by the like endowment of other departments.[1]

I must also express the great gratification that has been afforded me by the yearly allowance made by Mr. John Amory Lowell, Trustee, whereby the Society has been enabled to have lectures upon the several branches of science given in this room, of great value to the public; — and by the great generosity of Mr. John Cummings, by which the Society has been able to give courses of lectures to teachers, and to do much that it could not otherwise have done in employing labor on its collections.

In conclusion, allow me to express the hope that the same pleasant association that has drawn towards us and kept with us, officers and members of the Institutions in our neighborhood, may continue; for with them we should have no antagonism. Whatever is for their good is for ours, and the greater their success the more, I am sure, will our welfare be advanced.

At the close of the President's address Mr. George B. Emerson spoke warmly of the Society's progress during Mr. Bouvé's admistration, and of the great regret all would feel if he insisted on the acceptance of his resignation, which the speaker begged him to reconsider.

Prof. Wm. B. Rogers pleaded that, as the President himself admitted unfulfilled plans, he should consent to remain in office for the present, at least. He knew of no one who had served the Society so long and zealously, and believed that his resignation would be an irreparable loss. Both speakers were warmly applauded.

Mr. Bouvé cordially thanked the members for this expression of kind feeling towards him; he had, he said, fully purposed to insist on resigning, but he would now leave the question in the hands of the Nominating Committee. On motion of Messrs. Pickering and Shaler, it was unanimously voted to request the President to withdraw his resignation. Mr. Bouvé accordingly consented to its withdrawal.

Section of Entomology. March 22, 1876.

Mr. S. Henshaw in the chair.

The following papers were read:—

A CENTURY OF ORTHOPTERA. DECADE V.—FORFICULARIÆ (EXOTIC). BY SAMUEL H. SCUDDER.

41. Cylindrogaster nigra. Head black, minutely punctate, somewhat tumid, thinly covered posteriorly with short castaneous bristles; in front, opposite the upper base of the antennæ, a pair of tau-shaped smooth sulcations, their convexities inward, approaching nearest each other above, and between them, and a little above, a slightly transverse impression; mouth-parts reddish fuscous; antennæ dark reddish brown, the basal joint blackish. Prothorax and mesothorax black, punctate, covered, especially next the borders, with recumbent castaneous bristly hairs; the prothorax with a slight median impression on its anterior half, and on either side two short similar longitudinal impressions from the front edge backward. Femora blackish, the distal extremity and the extreme base of tibiæ luteous; rest of legs castaneous, darkest in middle of tibiæ. Abdomen black, covered beneath profusely, above scantily, with castaneous hairs, golden in a certain light; last segment angularly produced a little above the base of each of the forceps; these are short, conical, curved inward throughout, rather sharply pointed, unarmed. Length of body, excl. forceps, 11 mm.; length of forceps, 18 mm. Described from a single female from Para.

Neither Stål nor Dohrn, the only writers who have treated of the species of this genus, appear to have seen the female. In the one above described, and another which I refer with some doubt to *C.*

gracilis Stål, the structure of the abdomen is very different from that of the male. The ultimate, penultimate, and to some extent the antepenultimate dorsal segments are extremely short; and the forceps also being short, it has the appearance of being partially withdrawn within the body; the extremity of the abdomen is thus suddenly, bluntly rounded, and the last segment, instead of being conspicuous, as in the male, is scarcely visible at all above; beneath it is rather shorter than the others, its extremity broadly and regularly convex. As the tegmina and wings of both the females are wanting they may be immature, but they are otherwise so perfectly formed, and the metathorax resembles so closely that of the wingless genera, that I take them for perfectly developed insects, and conclude that the females of this genus are apterous.

42. **Labidura auditor.** This species differs from *L. riparia* principally in the character of the forceps. In the male these are more strongly and regularly arcuate than in *L. riparia*, not in the least curved upward, but lying in a horizontal plane, the middle tooth small, and scarcely affecting the curve of the interior edge of the forceps. In the female they curve downward rather than upward, and curve inward toward the tip more strongly than usual in *L. riparia*. The wings in both sexes are altogether wanting. In size, color, markings and sculpture, it altogether resembles *L. riparia.* 1 ♂, 1 ♀. Natal.

43. **Chelisoches comprimens.** Head piceous, smooth, the middle of the front a little tumid; mouth-parts dark reddish brown; basal joint of antennæ blackish, joints two to thirteen gradually growing paler, the three following pale yellow, and the remaining (eight or more) pale brownish fuscous. Prothorax blackish castaneous, the sides slightly marginate, a distinct sharp median sulcation and a dull semicircular sulcation uniting the front outer angles. Tegmina and exposed part of wings dark castaneous, the latter less than half as long as the former, together twice as long as the prothorax; tegmina docked with a sinuous curve, much as in *C. morio* (Fabr.). Legs dark castaneous, the tarsi luteous. Abdomen dark castaneous, profusely punctate, the posterior edges of the segments indistinctly beaded; lateral plications of second and third segments more distinct than in *C. morio*, and the whole abdomen not so slender as in that species. Forceps almost precisely as in *C. morio*, rather longer, and of the color of the abdomen. Length of body, 12 mm.;

of antennæ, 13 mm.; of tegmina and wings, 5.75 mm.; of hind femora, 3.3 mm.; of forceps, 5.75 mm. 1 ♀. Africa.

I propose the above generic name (derived from χηλή 'οχέω) as a substitute for Lobophora Serv., which is preoccupied in Lepidoptera (Curtis, 1825). *Forficula morio* Fabr. is the type.

44. Ancistrogaster arthritica. Head, antennæ, thorax, tegmina, wings and legs, covered uniformly and sparsely with short, fine erect hairs. Head and pronotum shining blackish brown, the head with a reddish tinge; antennæ very dark chestnut brown, the mouth parts a little lighter; between the base of the antennæ the front has a pair of triangular, rather deep impressions. Pronotum slightly longer than broad, the sides parallel, the posterior angles distinct, the hind border gently convex; there is a distinct median impression half as long as the pronotum, a little in advance of the middle. Tegmina and wings very dark chocolate brown, the latter with a small luteous spot almost concealed by the tegmina; tip of the tegmina squarely docked. Femora dark brown, the rest of the legs dirty luteous, the tarsi slightly paler. Abdomen dark testaceous above, dark castaneous below, darkest at the sides, on both surfaces profusely and uniformly punctulate; the abdomen broadens in the middle, and besides, the edges of the fourth to the sixth segments expand into lateral depressed teeth of considerable size, curved backward and shaped somewhat as in *A. luctuosa* Stål. They are first directed outward and a little backward, the hinder two with their anterior edges slightly and roundly excised, but otherwise suffering but little diminution in width; and then they bend suddenly backward and taper to a point, each with a greater or less angulation at the bend, most marked in the hinder two; the outer portion of the upper is nearly twice as long as that of the lower, and hence slenderer, and the middle one stands midway in character between the other two. The forceps have the general shape of those of *A. luctuosa*; the basal tooth, in the same place, is very slight and blunt, and is followed posteriorly by two or three granulations; the apex, which is finely pointed, is armed a little before the tip by a slightly recurved small triangular lamellate tooth, before which the edge is sparsely, beyond which it is densely pilose. Length of body, 10 mm.; of tegmina and wings, 5 mm.; of hind femora, 3.5 mm.; of front lateral abdominal tooth, 1.5 mm.; of forceps, 4.75 mm. 1 ♂. Brazil.

45. Forficula variana. Head and pronotum luteo-castaneous, the sides of the latter paler. Head smooth, with an oblique, broad, and rather shallow straight sulcation, extending from the middle of the inner side of the eye backward and inward, nearly following the suture; mouth parts dirty luteous, the palpi darker at base; antennæ 13-jointed, brownish luteous, slightly duskier at the tips of the joints, very minutely pilose. Pronotum smooth, a little depressed in the middle, especially at the sides, with a slight median impressed line; it is a little longer than broad, with the sides very nearly parallel, but diverging slightly; posterior edge a little convex, the posterior angles pretty distinct. Tegmina nearly twice as long as the pronotum, squarely docked at the apex, smooth, brownish fuscous on the inner, pale luteous on the outer half; closed wings extending beyond the tegmina by a distance nearly equal to the width of the pronotum, luteous, the inner edge blackish fuscous, more broadly in front than behind. Legs luteous, the tarsi paler, the femora tinged with castaneous. Abdomen piceous, the last joint or two dark castaneous, the whole sparsely punctate. Pygidium squarely and smoothly docked at the tip. Forceps luteous at base, blackish in the middle, dark castaneous at the tip. They are rather simple, flattened cylindrical, directed toward each other at the extreme base so as to become attingent, beyond straight, curving inward at the pointed tip; within they have a basal triangular expansion, beyond which the inner edge is straight to the curved tip, and finely crenulato-denticulate. Length of body, 8.75 mm.; of antennæ, 6 mm.; of tegmina and wings, 3.25 mm.; of hind femora, 2 mm.; of forceps, 2.75 mm. 1 ♀. Liberia.

46. **Forficula vellicans.** Head luteo-castaneous, smooth, slightly tumid; labrum dusky; palpi dull luteous; antennæ dark brown at base, growing paler beyond, 12-jointed, sparsely pilose. Pronotum quadrate, longer than broad, luteo-castaneous, uniformly and slightly tumid, the sides parallel, a little marginate, the middle with a faintly impressed longitudinal line, the hind margin slightly convex, all the angles square. Tegmina about half as long as the pronotum, squarely docked at the extremity, smooth, dull luteous, the inner edge sometimes a little dusky; wings wanting. Legs luteous; the femora, especially the hind femora, a little infuscated. Abdomen rather dark castaneous, profusely and rather finely punctate throughout, above and below; pygidium small, squarely docked, minutely trifid. Forceps simple, about two-thirds as long as the abdomen, flattened cylindrico-conical, attingent, nearly straight, but a little upcurved, the pointed tips incurved; inner edge slightly

rugulose. Length of body, 11.75 mm.; of antennæ, 8.5 mm.; of tegmina, 2.75 mm.; of hind femora, 3.25 mm., of forceps, 4 mm. 2 ♀. Brazil.

47. Forficula luteipes. Dark castaneous, smooth, slightly tumid; palpi luteo-fuscous, the tips dusky; antennæ (broken) very dark fuscous brown at base, paler brown beyond, sparsely pilose. Pronotum quadrate, scarcely longer than broad, dark castaneous, slightly tumid, the sides straight, flattened, scarcely margined, much lighter colored than the middle, a very faintly impressed median line; the posterior border gently convex. Tegmina fully half as long again as pronotum, dull luteous, broadly margined interiorly with fuscous, the tip squarely docked; wings projecting but little beyond the tegmina, the projecting portion about half as long as the pronotum, colored like the tegmina. Legs uniform luteous. Abdomen very dark castaneous, not punctate, but transversely wrinkled with exceedingly fine short wavy lines, occasionally reduced to punctæ. Pygidium small, trifid, the middle tooth larger than the others. Forceps simple, scarcely more than half as long as the abdomen, slightly depressed cylindrico-conical, attingent, nearly straight, but scarcely upcurved; the pointed tips incurved, the inner edge minutely denticulate. Length of body, 10.25 mm.; of tegmina and wings, 3.25 mm.; of hind femora, 2.5 mm.; of forceps, 3 mm. 2 ♀. Brazil.

This species is closely allied to *F. vellicans* Scudd., differing from it principally in the presence of wings, the non-punctate abdomen and the shorter forceps.

48. Forficula variicornis. Head black, with a reddish tinge, with a pair of puckered impressions dividing pretty equally the space between the upper bases of the antennæ; palpi brownish luteous; antennæ 10–11 jointed, the basal three or four joints brownish luteous, the penultimate joint pale luteous, all the others dark brown, verging toward black, all sparsely pilose. Pronotum quadrate, scarcely longer than broad, equal, the sides straight, the hind border gently convex; the middle of the anterior half a little tumid, with an impressed median line, which beyond the intumescence changes to a slight carina; blackish brown, the sides broadly, and the hind border narrowly dull luteous. Tegmina about twice as long as the pronotum, of a rich dark brown, the tip squarely docked. Projecting part of wings of same color, tipped interiorly and minutely with luteous, extending beyond the tegmina to a distance nearly equal to the width of the pronotum. Legs dull luteous, more or less obscured with fuscous, especially just before the tip of the femora. Abdomen very dark mahogany brown, the lateral plications of second and third segments very prominent, forming blunt conical tubercles; surface of abdomen nearly smooth; last dorsal segment in both sexes with a minute circular central depression. Forceps of male nearly three-quarters as long as the abdomen, flattened beneath, directed at first, for a short distance, horizontally and slightly outward, then, at a superior constriction, bent slightly upward and slightly inward to the incurved tip, which by a sudden constriction at its base resembles a claw; the lower inner edge of the upturned portion is distantly and very delicately denticulate, and the middle of the upper surface bears a large, laminate, compressed, triangular pointed tooth; forceps of female simple, slender, approximated at the base, and beyond attingent and straight to the finely pointed incurved tip; they are nearly horizontal but regularly curved, first downward and then upward, minutely denticulate along inner edge. Length of body, 9 mm.; of antennæ, 7 mm.; of wings and tegmina, 3.5 mm.; of hind femora, 2.5 mm.; of forceps, 3.5 mm. 3 ♂, 4 ♀. Brazil.

49. Forficula hirsuta. Head dark mahogany brown, the front tumid, with a pair of short longitudinal furrows dividing the space between the antennæ; palpi dull luteous; antennæ (broken beyond fifth joint) uniformly dark mahogany brown. Pronotum as in *F. variicornis*, but uniformly reddish black, the sides slightly elevated. Tegmina dark reddish brown, twice as long as the pronotum, squarely docked at tip; wings of same color, scarcely tipped with dirty luteous. Femora uniform dark reddish brown; rest of legs dull luteous. Abdomen dark reddish brown, the posterior edges of the segments blackish, the lateral plications of the second and third segments prominent, the surface profusely, minutely and transversely punctato-striate with abbreviated striæ, the last segment with a short median longitudinal impression. Head, antennæ, prothorax, base and lower edge of tegmina, exposed part of wings, legs and abdomen rather sparsely covered with moderately long pile. Forceps nearly as long as the abdomen, very slender, cylindrical, approximated at base, beyond attingent, straight to the incurved pointed tip. Length of body, 9.75 mm.; of tegmina and wings, 4.5 mm.; of hind femora, 2.9 mm.; of forceps, 4 mm. 1 ♀. Brazil.

This species is closely allied to *F. variicornis* Scudd., differing from it principally in the uniform and dark coloring of the antennæ and femora, the hirsuteness of the whole body, the punctate abdomen and the slender forceps.

50. Labia arcuata. Head black, slightly tumid, very minutely rugulose, covered with very short pile, palpi dark brown; antennæ with eleven joints, pilose, blackish brown, the terminal half of the apical joint pale. Pronotum black, the sides scarcely tinged with testaceous, quadrate, scarcely longer than broad, scarcely narrowing posteriorly, the sides straight, the posterior angle well marked, hind edge gently convex; the front half slightly tumid, with a median impressed line, the rest flat. Tegmina glistening black, covered with short pile, more than twice as long as the pronotum, each as broad as the pronotum, the apex roundly excised; exposed part of wings slender, almost pointed, black, nearly as long as the pronotum. Legs dark brown, the apical half of tibiæ and tarsi growing lighter. Abdomen dark mahogany brown above, blackish at the sides, castaneous below, covered wholly with short pile. Pygidium very broad, bifid, with large teeth. Forceps about a third as long as the abdomen, strongly arcuate, trigono-arcuate on basal, straighter half; beyond flattened cylindrical, bent inward, nearly straight, and the apex pointed and not incurved; the inner surface is nearly flat, with an upper and lower edge; the upper edge is smooth, with a minute tooth near the base; the lower edge has a larger triangular laminate tooth slightly further from the base, and directed a little downward. Length of body, 6.4 mm.; of antennæ, 4.1 mm.; of tegmina and wings, 3 mm.; of hind femora, 1.3 mm.; of forceps, 1.6 mm. 1 ♂. Vassouras, one hundred miles north of Rio, Brazil, taken March 5. (B. P. Mann.)

A Century of Orthoptera. Decade VI. — Forficulariæ (N. American). By Samuel H. Scudder.

51. Neolobophora volsella. Head smooth, glistening, vinous red, the eyes piceous, and the front strongly obscured with blackish, sutures of the head deeply impressed, and either hemisphere of the occiput intumescent; antennæ blackish fuscous, gradually growing a little paler toward the tip, the basal joint often tinged with reddish; thorax and abdomen piceous, the sides of the prothorax dull luteous. Prothorax smooth, with very delicate and faint infrequent transverse furrows, and a very slight median sulcation.

Tegmina slightly longer than broad, the hinder edge cut obliquely in a gentle curve, so that when at rest the combined hinder edges form a slight concave curve. Wings wanting. Legs luteous, the apical half of the fore and middle femora and the apical third of the hind femora black, or blackish fuscous. Abdomen very distantly and very minutely punctulate, each pit giving rise to a minute short hair. Forceps long and very slender, those of the female nearly as long as the abdomen, attingent, subquadrate, straight until close to the tip and then curved slightly inward, unarmed, vinous red, slightly obscured at the tip; those of the male nearly twice as long as the abdomen, the basal half subquadrate, very slightly bowed in opposite directions, the inner edges delicately toothed or granulate, with a slight but distinct tooth in the middle, beyond which the arms of the forceps are subcylindrical, subattingent, and have the curve of the female; the basal half is mostly vinous red, more or less obscured, especially toward the tip, the apical half blackish. Length of body excluding forceps, 12–13 mm.; of antennæ, 8.5 mm.; of tegmina, 2.5 mm.; of hind femora, 3.5 mm.; of forceps, ♂, 10.5 mm., ♀, 5.25 mm. Described from 4 ♂, 3 ♀, taken by Sumichrast (No. 6) in the mountains about Orizaba, Mexico, under bark in the month of January. Smithsonian Institution.

In describing this genus I stated that the terminal segment of the abdomen was alike in both sexes; this is not strictly true, that of the female narrowing much more rapidly than that of the male. I also compared it with the old world Lobophora, but failed at the time, for want of proper material, to see its much closer affinity to Nannopygia.

52. **Thermastris Chontalia.** Head black, the mouth parts luteo-fuscous, obscured with blackish. Antennæ with more than thirty-four joints, the first and third joints stouter and shorter than in *T. brasiliensis*, the first twelve and thirteen joints blackish fuscous, beyond growing paler fuscous. Prothorax and tegmina blackish brown, with very distant, short, stout, tapering hairs; pronotum nearly flat, with a very obscure median longitudinal depression; tegmina sinuously and obliquely docked at tip, twice as long as the prothorax; the projecting portion of the wings, as in the other species of the genus, is covered with hairs like those on the tegmina, and squarely docked at extreme tip, but unlike the other species is of the same color as the tegmina, with very slightly paler inner edge. Legs dirty yellowish brown, the femora covered sparsely with spinous hairs, the tibiæ and tarsi blackish above. Abdomen dull castaneous, rugulose, the last

dorsal segment with a broad median depression, and the hinder edge scarcely produced angularly over each of the arms of the forceps. Forceps flattened triquetral, moderately stout, as long as the tegmina, straight nearly to the tip, then rather sharply incurved to a bluntly pointed tip; inner double edge irregularly but rather frequently toothed, larger at base than beyond, but furnished with a not very conspicuous broad triangular laminate tooth just beyond the middle. Length of body, 18.5 mm.; of antennæ, 15 mm.; of tegmina and folded wings, 7.75 mm.; of hind femora, 4 mm.; of forceps, 6.25 mm. 1 ♀. Chontales, Nicaragua.

This species differs distinctly from *T. brasiliensis* and *T. Saussurei* in having longer forceps and nearly uniformly dark wings, of the color of the tegmina.

53. Spongophora forfex. Dark castaneous brown, the mouth parts scarcely paler, the antennæ castaneous, becoming infuscated beyond the base. Legs luteo-castaneous, the front of the femora blackish fuscous; exposed part of wings pale mahogany brown; tip of the tegmina obliquely docked, slightly and roundly excised, and next the inner edge strongly produced; posterior edge of the abdominal segments with a series of closely crowded minute notches; terminal segment rugulose, with granulations, which are absent from the two stripes down the middle, grow larger and more abundant posteriorly, and bead the posterior edge. Forceps reddish, nearly as long as the body, depressed cylindrical, very slender, nearly straight, slightly incurved on the basal half, beyond straight and then incurved at the tip, the extremity of which is pointed; the inner edge is slightly rugulose, and just before the middle has a slight tooth. Length of body, 22 mm.; of tegmina and wings, 9.5 mm.; of hind femora, 4.25 mm.; of forceps, 19 mm. 1 ♂ from the collection of Dr. Schaum; the locality is unknown, but is doubtless some part of tropical or subtropical America. It belongs to the group of *S. parallela* (Westw.) and *S. prolixa* (*Psalid. parallela* Dohrn nec Westw.), but differs from them in coloration, and in the structure of the forceps.

54. Ancistrogaster gulosa. Head very dark castaneous brown with very thin short pile on the occiput; antennæ 12-jointed, pale brown, the basal joint darker; palpi pale brown. Pronotum dark brown, the sides dull luteous, slightly broader than long (♂), or of equal length and breadth (♀), the sides slightly convex, slightly narrowing posteriorly, the posterior margin well rounded; broadly depressed just behind the centre with a faintly impressed median line and two short longitudinal lines on either side in front; covered throughout with thin pile, as also are the tegmina and wings; tegmina uniform dark brown, squarely docked at the tip, about twice as long as the pronotum, the wings dull luteous. Femora rather light brown, covered sparsely with short pile, the tip paler; tibiæ dirty luteous, tarsi pale yellowish. Abdomen dark brown, finely and sparsely punctulate, the punctulations giving rise to short, fine golden hairs, which also cover the forceps; sides of the fourth and fifth abdominal segments produced posteriorly to sharp angles, but inconspicuous; the abdomen itself broadens and thickens regularly on the first three or four segments, and then narrows more rapidly, and the sides of the last segment are parallel. Forceps of female straight, simple, attingent, curving inward at tip and pointed, unarmed excepting a slight denticulation on the inner edge. Those of the male resemble in their general direction those of *A. arthritica* Scudd., but are more strongly bent near the base; at the extreme base the inner edge bears a prominent, rather stout pointed triangular tooth, and the lower inner edge beyond it is rudely denticulate; the forceps are not depressed as in *A. arthritica,* but trigono-cylindrical, the inner surface flat; but at the tip, which does not diminish in size, they become flattened, and terminate in a nearly straight edge, those of the opposite arms meeting; either end of the blade developing a pointed tooth, the preapical one small and bifid, the apical rather long and incurved. Length of body, 10.5–13 mm; of antennæ, 11 mm.; of tegmina and wings, 4.5 mm.; of hind femora, 4 mm.; of forceps, ♂, 4.5 mm., ♀, 3.1 mm. Described from 5 ♂, 1 ♀, taken by Sumichrast (No. 4) in Puebla, Mexico (terra frigida) in January. Smithsonian Institution.

55. Forficula vara. Head dark mahogany brown, palpi and antennæ dark luteous, the latter 11–12 jointed; head smooth, full, devoid of impressions. Pronotum subquadrate, scarcely as long as broad, dark reddish brown, the sides lutescent, the front border straight, the sides straight and parallel, the posterior angles broadly rounded; the surface smooth, with a scarcely apparent median sulcation. Tegmina dark brown with a reddish tinge, a little longer than the pronotum, docked with a slight obliquity; wings wanting. Legs luteous, the outer edge of the tibiæ dusky. Abdomen dark mahogany brown, stout and plump, very slightly larger in the middle than at either extremity in the male, enlarging slightly to the fifth dorsal segment, and then suddenly tapering in the female; surface nearly smooth beneath, thinly pilose; last dorsal segment squarely docked in the ♂, the forceps strongly bowed and widely distant; at base these are flattened, directed outward and upward; then, a little before the end of the basal third, they are turned inward and curve downward and again upward, becoming flattened trigonate, and tapering to a blunt point; the inner edge is rather rudely but minutely denticulate near the base, beyond more or less crenulate; the forceps of the ♀ are simple cylindrico-trigonate, attingent, straight, slightly incurved next the pointed tip, minutely denticulate along the inner edge. Length of body, ♂, 8–9.75 mm., ♀, 7–8 mm.; of antennæ, 6 mm.; of tegmina, 1.5–2 mm.; of hind femora, 2.1–2.8 mm.; of forceps, ♂, 2.9–3.4 mm.; ♀, 2–2.6 mm. Described from 9 ♂, 8 ♀, collected by Sumichrast (No. 2) at Puebla, Mexico (terra frigida), in January. Smithsonian Institution.

This species approaches more closely to the European *Forf. bipunctata* Fabr. than any known to me, but it still preserves the characteristic features of the true Forficulæ and not of the genus Anechura, which I shall propose in another paper for the European species mentioned.

56. Forficula tolteca. Head dull castaneous, smooth, but sparsely pilose, slightly tumid, with a transverse brace-shaped slight sulcation between the antennæ; palpi dirty luteous; antennæ with the basal joint dirty luteous, beyond light brown, the tenth pale, excepting at the extremities (beyond broken). Pronotum rufo-luteous, dull luteous at the sides, scarcely broader than long, well rounded posteriorly, with a slightly impressed median line on the anterior, and a slight carina on the posterior half, the whole flat, sparsely pilose. Tegmina dark brown, twice as long as the pronotum, squarely docked at the extremity, sparsely pilose; the exposed part of the wings dull luteous, more or less infuscated on the borders, sparsely pilose, as long as the pronotum. Legs luteous, sparsely pilose, the femora slightly and broadly fuscous toward the tip, the tibiæ still less so toward the base. Abdomen rather short and full, with convex sides, dark castaneous, more or less blackish toward the sides, very delicately and transversely striate, more or less pilose, the lateral tubercles rather prominent. Forceps more than half as long as the abdomen, depressed cylindrical, simple, straight, attingent, incurved at the tip, and very sharply pointed, sparsely pilose throughout, the inner edge very finely denticulate. Length of body, 8 mm.; of tegmina and wings, 3 mm.; of hind femora, 2.75 mm.; of forceps, 2.4 mm. 2 ♀. Mexico, Sumichrast. (Smithsonian Institution.)

57. Forficula exilis. Head mahogany brown, smooth, the middle of it slightly tumid, with a pair of broad shallow oblique sulcations between the antennæ, meeting each other above and forming a /\; labrum dusky; palpi brownish luteous, paler toward tip; basal joint of antennæ mahogany brown; remaining joints (at least as far as the ninth) reddish brown. Pronotum luteous, rufous in the middle, quadrate, slightly longer than broad, scarcely broader posteriorly, the sides straight, the posterior border gently convex, the surface smooth, flat, a little depressed excepting down the middle, which bears an impressed line, fading posteriorly. Tegmina nearly twice as long as the pronotum, luteous, duskily bordered on the inner side; wings scarcely extending beyond the tegmina, similarly colored; legs luteous, the femora slightly tinged with brown. Abdomen very slender, the sides scarcely convex, very dark mahogany brown, the surface minutely and sparsely punctulate; last segment quadrate, the posterior area deeply transversely depressed in the middle, with a slight short longitudinal impressed median line at the anterior limit of the same, preceded by a pair of submedian, almost equally short, very faintly impressed lines; the depression is bordered laterally next base of either arm of forceps by a blunt tubercle. Forceps rather simple, as long as the last four or five dorsal segments, rather broad at base, narrowing suddenly beyond, and then depressed cylindrical, slender and tapering, gently incurved and finely pointed; inner edge slightly tuberculato-denticulate, especially on the basal half, a slightly larger tubercle at the middle of the apical half. Pygidium a pointed flattened triangular lamina. Length of body, 10.5 mm.; of tegmina and wings, 2.5 mm.; of hind femora, 2.1 mm.; of forceps, 3.75 mm. 1 ♂. Texas; received from Mr. P. R. Uhler.

58. Forficula aculeata. Head uniform rather dark castaneous, smooth, gently tumid, with a pair of oblique, slightly bent impressions between the antennæ; palpi luteous; antennæ 12-jointed, dark brown, becoming paler away from the base, the extreme tips of some of the basal joints marked with blackish. Pronotum rather dark castaneous, the sides transparent and nearly colorless, quadrate, noticeably longer than broad, the sides parallel and straight, the hind border a little convex with rounded posterior angles, the surface smooth, nearly flat, with a broad and very shallow transverse postmedian impression, and a slight impressed longitudinal line about half as long as the pronotum, starting from a little behind the front edge. Tegmina nearly twice as long as the pronotum, squarely docked at the tip, smooth, luteous, with the inner half, or nearly as much, obscured more or less heavily with fuseous. Wings wanting. Legs uniform luteous. Abdomen dark mahogany brown, sometimes varying to black, with the sides of the second and third segments blackish, the lateral plications of the third segment rather prominent, all the segments but the last finely punctate, the last as *F. californica* is described by Dohrn. Forceps of female rather more than half as long as the abdomen, simple, slender, attingent, straight to the incurved tip, the inner edge quite straight to the tip, minutely denticulate; those of male about three-quarters as long as the abdomen, the basal fourth moderately stout, triquetral, distant, directed slightly outward and bent at the very base downward, the remainder bent inward, but continuing the downward direction until near the horizontal tip, cylindrical, slender, nearly equal, until a little beyond the middle of the outer half, where at the emission of an inner rather stout tooth, it tapers to a fine point, begins an inward curve and takes on the horizontal direction; the inner side is edged, at base laminate, and rather finely denticulato-tuberculate. Pygidium of ♀ stout, bluntly trifid, of ♂ very slender, acicular, half as long as the last segment. Length of body, 10.75 mm.; of antennæ, 7.5 mm.; of tegmina, 3.1 mm.; of hind femora, 2.8 mm.; of forceps, ♂, 5 mm., ♀, 3.5 mm. 3 ♂, 5 ♀ from N. York (Coll. Uhler), Northern Illinois (Kennicott), Southern Michigan (Prof. M. Miles, No. 124). A single specimen is marked Cuba ?

This species is closely allied to *F. californica* Dohrn, judging from the description, but differs from it in the total want of wings, and the structure of the male forceps. It appears also to be nearly allied to *F. pulchella* Serv., a species I do not know, but the absence of wings in our species prevents its reference to it. *F. pulchella* is possibly a Labia.

59. Labia rotundata. Head dark mahogany brown, darkest below, but the labrum lighter, uniformly and slightly tumid; palpi reddish brown, darkest on the apical half; antennæ more than 10-jointed, the basal joint reddish brown, beyond a little duskier, the whole briefly pilose. Pronotum nearly as broad as the head, reddish luteous, paler at the sides, scarcely longer than broad, the posterior angles very broadly rounded, but the hind margin otherwise straight; it is depressed excepting in the middle of the front half, on which is a finely impressed median line; lateral edges almost marginate. Tegmina about half as long again as the pronotum, dull brownish luteous, squarely docked at tip; wings extending but a little beyond the tegmina, blackish. Legs luteous. Abdomen very broadly expanded, the sides unusually convex, blackish brown above, the apical joints and whole under surface mahogany brown; surface very finely longitudinally striate. Pygidium large, truncate, conical; forceps scarcely one-third the length of the abdomen, simple, widely separated, cylindrical, straight, incurved at tip, finely pointed, briefly pilose, wholly unarmed. Length of body, 6 mm.; of (ten joints of the) antennæ, 2.75 mm.; of tegmina and wings, 2 mm.; of hind femora, 1.6 mm.; of forceps, 1.5 mm. 1 ♀. Mexico.

60. Labia brunnea. Head rather dark castaneous, smooth, slightly tumid, with two faint, broad, short, shallow, nearly longitudinal impressions between the antennæ; mouth parts luteo-castaneous. Antennæ 11-jointed, luteo-castaneous. Pronotum nearly as broad as the head, scarcely broader posteriorly than anteriorly, of equal length and breadth, quadrate, the posterior angles rounded, and the hind border otherwise straight, slightly tumid anteriorly, with a slight median impressed line, which posteriorly is supplanted by a pair of closely approximated similar lines, rather dark castaneous, broadly bordered on the sides and hind margin with luteous, which is separated from the castaneous by a blackish fuscous belt. Tegmina castaneo-fuscous, darkest next the base, fully half as long again as the pronotum, squarely docked at the tip; wings rudimentary, useless. Legs castaneo-luteous, the femora slightly infuscated. Abdomen dark castaneous, the posterior borders of the segments marked with blackish, the sides of the abdomen somewhat convex, the lateral plications of second and third segments rather slight, the surface very finely and faintly punctulate. Pygidium of male very coarse and stout, bluntly conical and truncate. Forceps of male more than half as long as the abdomen, simple, trigono-cylindrical, a little depressed, rather stout, horizontal, gently incurved, with a basal and preapical slight triangular depressed pointed tooth on the inner edge; the apex bluntly pointed, depressed. Forceps of female (pupa) about one-third as long as the abdomen, simple, straight on the middle half, but as a whole slightly sinuate, horizontal, depressed, but broadly ridged above, the inner edge delicately toothed, fading out toward tip. Length of body, 6.5 mm.; of antennæ, 2.8 mm.; of tegmina, 1.5 mm.; of hind femora, 1.5 mm.; of forceps, ♂, 2.25 mm., ♀ (pupa), 1.6 mm. 1 ♂, 1 ♀. Cuba (P. R. Uhler).

Description of Three Species of Labia from the Southern United States. By Samuel H. Scudder.

Labia guttata. Head castaneous black, the labrum dark luteous and the parts above luteo-castaneous; surface smooth, shining, a little tumid, with two pair of inconspicuous puncta, one above the other, between the antennæ; palpi luteous; antennæ 12–13-jointed, luteous at base, growing infuscated beyond, the apical half brownish fuscous, the whole sparsely pilose. Pronotum slightly narrower than the head in front, of equal width with it behind, of the color of the head, with sides narrowly, but distinctly, and hind border very broadly, but inconspicuously, dull luteous; surface smooth, nearly flat, with a slight median impressed line; sides slightly marginate; hind border scarcely convex. Tegmina very dark castaneous brown, half as long again as the pronotum, tip squarely docked; exposed part of wings half as long as the tegmina, brownish fuscous, with a large, slightly longitudinal, clear luteous spot in the middle of the base, and the entire edge inconspicuously and narrowly margined with dull luteous. Legs uniform bright luteous. Abdomen with the three or four basal joints blackish, beyond blackish castaneous, the terminal joints rich dark castaneous; sides nearly parallel in the ♂, somewhat convex in the ♀, the lateral plications of the second and third segments slight, the surface minutely punctured, but the last segment nearly smooth; this segment is quadrate above in the male, with straight hind border, scarcely depressed posteriorly in the middle, with a short median impressed line not quarter the length of the segment, near the hind border; in the ♀ the dorsal segment is tapering, and has a distinct longitudinal impressed line on the whole apical half of the segment. Pygidium of ♂ as in *L. Burgessii.* Forceps of ♀ of the color of the abdomen, but growing darker toward the tip, moderately stout, more than half the length of the abdomen, depressed trigonate, with a superior ridge, slightly upturned, slightly incurved on apical half, which is almost laminate and bluntly pointed, the inner edge rugose, with a slight blunt extreme basal tooth; forceps of ♂ rather slender, rather more than half as long as the abdomen, shaped as in *L. Burgessii.* Length of body, 6 mm.; of antennæ, 3.5 mm.; of tegmina and wings, 3.1 mm.; of hind femora, 1.6 mm.; of forceps, ♂, 2.5 mm., ♀, 2.25 mm. 1 ♂, 2 ♀. Texas (G. W. Belfrage).

This species agrees better than any I have seen with *Forf. pulchella* Serv., judging from the imperfect descriptions of Serville; but it is much smaller than that species, does not agree with it in the proportion of its parts, and has no such disparity in the length of the forceps in the two sexes. The forceps of the male of *L. guttata* possessses a postmedian tooth, which could hardly have been overlooked by Serville, and the parti-colored abdomen, if a constant character would distinguish it from Serville's species. It curiously resembles *Spongophora brunneipennis* Serv.

Labia Burgessii. Head rather dark castaneous, tumid, with two slight depressions between the antennæ, lower part of front, labrum and palpi pale luteous. Antennæ 13-jointed, the basal two or three joints pale luteous, beyond brownish luteous becoming duskier toward the tip, the joints sparsely pilose. Pronotum as broad anteriorly as the head, broadening posteriorly a very little, sides straight, posterior border gently convex, the front portion very slightly tumid, a slightly impressed median line, sides slightly marginate and a little paler than the slightly infuscated luteous disc. Tegmina fusco-luteous, but little longer than the pronotum, squarely docked at the apex; wings nearly obsolete, useless. Legs very pale luteous, with a few scattered hairs. Abdomen rather long, with nearly parallel sides, especially in the male, dark rich castaneous with dusky incisures, the last joint generally a little paler; lateral plications of second and third segments slight; last segment of male quadrate, twice as broad as long, of female subquadrate, tapering, about two-thirds as long as broad, of both depressed in the middle posteriorly, with a very short longitudinal impressed line in the anterior half of the depression, and next the inner base of the forceps, especially in the male, a minute blunt roughened tubercle. Pygidium of female small quadrate, scarcely longer than broad, minutely trifid, or rather armed apically with three minute teeth; of male large, quadrate, more than twice as broad as long, the outer angles produced to a minute point, the posterior border sinuato-convex with a slight point, more or less distinct, near the middle of either lateral half. Forceps of ♀ not more than one-third the length of the abdomen, simple, trigonate and straight on basal half, flattened and incurved on apical half, the inferior inner edge roundly and slightly excised at base, and beyond minutely and bluntly denticulate as far as the middle, the superior edge similarly denticulate on the basal half with a slightly more prominent tooth at the base. Forceps of ♂ about one-half the length of the abdomen, slender, horizontal, gently arcuate, longitudinally channeled on basal third above, depressed on apical half, scarcely tapering and bluntly pointed, the inferior inner edge with a basal depressed distinct laminate pointed tooth, the laminate, more gently sloped, anterior edge of which is minutely denticulate, the inner surface with a similar but not laminate and blunter tooth a little farther from the apex than the basal tooth is from the base, the apical tooth occasionally subobsolete. Length of body, ♂, 6.75–8.25 mm., ♀, 7.9–9.35 mm.; of antennæ, 2.6–4.75 mm.; of tegmina, 1.5–1.9 mm.; of hind femora, 1.4–1.7 mm.; of forceps, ♂, 2.5–3.5 mm., ♀, 2.15–3 mm. 7 ♂, 7 ♀, and 7 immature specimens. Pilatka, Florida, Feb., 1868 (E. Burgess).

The pygidium of the immature ♀ is bifid, and the forceps resemble those of the mature animal, but are simpler, irregularly denticulate almost to the tip and lack the regular basal excision. The pygidium of the young ♂ is also bifid, and as long as broad, and the forceps closely resemble those of the immature female, but are slenderer, more cylindrical, and not so closely attingent. It is apparently a female of this species, but with inaccurate coloring, which is figured in Glover's Illustrations of N. Am. Entomology, Orth., pl. VI, fig. 19, and credited to New York.

Labia melancholica. Head reddish black, the lower part of the front and labrum reddish luteous, blotched with blackish, the rest tumid, smooth, shining. Palpi rather bright luteous. Antennæ 13-jointed, bright luteous on basal third, beyond growing more and more fuscous to the completely dusky tip, the joints longer than usual, but distinctly moniliform, very sparsely pilose. Pronotum slightly broadest posteriorly, and here as broad as the head, tumid in a large semicircular area in front, and here reddish black, the remainder flat, rather dark luteous; it is a little longer than broad, the sides slightly marginate, the posterior angles broadly rounded, the hind border otherwise scarcely convex; median impressed line very slight. Tegmina reddish black, nearly twice as long as the pronotnm, the extremity squarely docked with a slight obliquity; exposed part of wings nearly two-thirds as long as the tegmina, slender, blackish castaneous. Legs luteous, the middle and hind femora slightly castaneous. Abdomen long and slender, the sides nearly parallel, dark mahogany brown, blackish toward the base, lighter beneath, shining, the surface distantly and very finely and slightly wrinkled or subrugulose; lateral plications inconspicuous; last segment slightly tapering, two-thirds as long as broad, smooth on either side of the middle, slightly tumid and rugulose next base of forceps, and between depressed with a short median longitudinal impressed line. Forceps of female less than half the length of the abdomen, moderately stout, simple, nearly horizontal but slightly curved, the convexity downward, depressed trigonate with a superior ridge, tapering regularly, straight on the basal two-thirds and then gently and regularly incurved, the tip bluntly pointed; inner edge with a superior small basal bifid tooth, and on the inferior edge slight denticulate sinuations on the basal half. Length of body, 8.25 mm.; of antennæ, 4 mm.; of tegmina and wings, 3.6 mm.; of hind femora, 1.75 mm.; of forceps, 2.1 mm. 1 ♀. Waco, Texas; collected by G. W. Belfrage on February 24th.

A slender, graceful and very dark colored species, nearly related to the almost apterous *L. Burgessii.* Probably the male forceps of the two species will prove to be somewhat similar.

Orthoptera from the Island of Guadalupe.
By Samuel H. Scudder.]

The four Orthoptera described below comprise all the species that were collected by Dr. E. Palmer during a recent visit to the Island of Guadalupe, off the coast of Lower California. Two of the species, as will be seen, also occur in the southern part of California, and one of them also in Mexico; the third Acridian will very probably be discovered there, but the Gryllus, which appears to be more nearly related to *G. peruvianus* Sauss., than to any other species, will not improbably prove indigenous, and is remarkable for the brevity of its tegmina and wings. None of them appear to have been described.

Gryllus insularis. Of medium size. Head shining black, tumid, with a broad shallow depression between the lateral ocelli and just above the median ocellus; antennæ nearly twice as long as the body, black, growing a little testaceous from end of the basal third toward the tip; middle of mandibles and galea more or less tinged with reddish; palpi blackish brown. Pronotum black, shining, nearly twice as broad as long, with a slight median impressed line more distinct in front; front border straight, or scarcely angulate in front, the angle opening forward; hind border straight, or slightly full in the middle, very delicately marginate, laterally with a few curved black bristles. Tegmina rather dark testaceous, slightly more (♂) or slightly less (♀) than half as long as the abdomen, rather broad, the reticulation prominent. Wings scarcely as long as the tegmina. Fore and middle legs, as well as the sternum, blackish; the sides of the femora, under surface of the tibiæ and all but the upper edge of the tarsi, suffused more or less with dark red. Hind femora extending beyond the end of the abdomen, large and tumid, reddish, excepting the blackish tip; hind tibiæ and tarsi dark fusco-castaneous. Abdomen black; cerci nearly as long as the abdomen, dark brown, and clothed with black hairs; ovipositor as long as the body, reddish testaceous, with a black base and blackish tip, and a couple of lateral black lines. Length of body, ♂, 18 mm., ♀, 20 mm.; width of pronotum, ♂, 6.25 mm., ♀, 6.5 mm.; of antennæ, ♀, 39 mm.; of tegmina, ♂, 7 mm., ♀, 6–7 mm.; of hind femora, ♂, 12.5 mm., ♀, 13.5 mm.; of cerci, ♀, 13 mm.; of ovipositor, 19 mm.

1 ♂, 2 ♀. Guadalupe Isl., off Lower California (E. Palmer). specimens dried after immersion in alcohol.

Acridium vagum. Size of *A. americanum* (Drury). Head varying from livid to light clay-brown, marked with black; the whole lower half of the head and the region behind the eyes, is heavily blotched with it, in the latter case, mostly arranged in oblique specks, while the rest of the face is serially punctate with black, especially on either side of the carinæ; on either edge of the frontal costa the black dots are clustered into a straight black stripe, which continues past the eyes over the vertex to the back of the head; a black stripe also runs from the lower edge of the eyes to the lower hinder edge of the head (these colours become partially or wholly obliterated after immersion in alcohol); the vertex is slightly concave, the lateral foveolæ flat, equal, punctate, the frontal scarcely contracted between the antennæ, slightly widening below, a little channelled at and a short distance below the ocellus; palpi livid, flecked with fuscous; antennæ pale cinereous, a little lighter at the tip. Dorsum and whole posterior lobe of pronotum grayish cinereous, or clay-brown, obscurely flecked with longitudinal dashes of blackish fuscous, especially upon the anterior lobe; lower third of lateral lobes fusco-luteous, surmounted by a very broad blackish belt which fades on entering the posterior lobe; anterior lobe faintly rugulose, posterior coarsely punctate, both with an equal, blunt, not greatly elevated median ridge, cut by transverse furrows in the middle, in the middle of the anterior half and in the middle of the second quarter; front margin slightly full; hind margin bent at a right angle, the angle broadly rounded. Tegmina with the basal three-fifths pale clay-brown, the apical portion nearly vitreous, the whole very heavily flecked with blackish fuscous, rather lighter apically; these markings are present on the upper area of the closed tegmina only as minute spots or dots, but along the median area, commencing at the very base, they form longitudinal quadrate patches, broadening, becoming less compact and less intense away from the base; the apical half is filled with small, not very unequal, squarish patches, irregularly and profusely distributed. Wings pellucid, scarcely fuliginous, with a faint yellowish tinge at the base, all the nervures black, excepting at the extreme costal border, where just beyond the middle some of them are ferruginous. Hind femora pale hoary blue, with very pale yellowish brown oblique rays on the sides, faintly and distantly punctate with black, with faint ferruginous outer and superior carinæ, the upper surface broadly banded with black in four broken bands; hind tibiæ dusky plumbeous, the upper surface blackish, excepting at the tip, the spines white, with the apical third black. Length of body 45–52 mm.; of antennæ (13 est.)–15 mm.; of pronotum, 9–10.5 mm.; of tegmina, 48–53.5 mm.; of hind femora, 25–28 mm.

8 ♀. Island Guadalupe, off Lower California (E. Palmer); San Diego, California (J. Behrens); California (H. Edwards).

This insect belongs to the division Schistocerca of Stål.

Trimerotropis vinculata. Ash gray, blotched with dark fuscous; foveolæ of the head distinct, the costæ being prominent throughout; tip of fastigium with a rather deep circular or posteriorly angulated pit having abrupt sides, reaching the margins of the lateral foveolæ; antennæ dark brown, very obscurely annulate with darker and lighter colors. Median carina of pronotum distinct only on front lobe, and cut behind the middle by the transverse sulcus, the hinder portion of the anterior lobe somewhat corrugate; hind border of pronotum forming a right angle. Tegmina as long as the hind legs, the basal third testaceous, with a fuscous cloud on its apical third, and fuscous dots sprinkled over the rest; middle third ashen, with a fuscous cloud traversing the entire breadth of the wing in the middle, broadest centrally; apical third pellucid, sprinkled with small fuscous spots, fainter than the previous ones, closely clustered basally, distant and fainter apically. Wings very faint lemon-yellow at base, pellucid with black nervules at apex, and near the middle a broad band of blackish fuliginous; it commences on the middle of the costal margin, half as broad as the tegmina, suddenly broadens by a narrow interior shoot to double or more than double its former width, and then passes nearly at right angles to the costal border, but directed a little obliquely outward, slightly broadening as it goes, to the outer margin, which it turns toward the anal angle, narrowing and fading until it has traversed nearly or quite three-quarters of the anal area; its margins are ill defined and slightly irregular, but its general form is a sickle-like curve, which greatly resembles that of most species of Spharagemon. Hind femora ash-gray, with two or three faint, ill defined, slightly oblique fuscous bands. Hind tibiæ yellow, the spines black tipped. Length (of an average specimen), ♂, 19 mm., ♀, 28 mm.; of antennæ, ♂, 8 mm., ♀, 9.75 mm.; of tegmina, ♂, 24 mm., ♀, 30 mm.; of hind femora, ♂, 11 mm., ♀, 13.5 mm.

6 ♂, 9 ♀. Guadalupe Island, off Lower California (E. Palmer); San Diego, Cal. (H. Edwards, No. 9). Mexico, (Coll. Schaum).

Trimerotropis lauta. Head livid gray, completely sprinkled with fuscous dots, giving a fuscous appearance to the upper surface; antennæ dirty dull luteous, annulate, with dark fuscous on basal half. Pronotum flat above, the front lobe dirty yellow, its posterior half tuberculate; posterior lobe livid, heavily dotted with reddish brown on the little rugosities; upper half of lateral lobes reddish brown, lower half like the head. Tegmina scarcely shorter than the hind legs, obscure pellucid on basal half, heavily flecked with light brownish fuscous blotches, mostly concentrated into a large broken patch, occupying most of the basal third of the wing, and a triangular patch in the middle of the wing, its apex next the costa; outer half of wing pellucid, sprinkled almost uniformly with small moderately distant subequal faint fuscous spots. Wings pellucid, with no trace of any band, a few of the apical cells filled with a fuscous cloud. Hind femora reaching the tip of the abdomen, ash gray, with a premedian and postmedian narrow lateral oblique brownish fuscous stripe. Hind femora livid, flecked with fuscous, with a faint pale prebasal annulus, the apex infuscated and the spine-tips black. Length of body, 15.5 mm.; of antennæ, 8.5 mm.; of tegmina, 18 mm.; of hind femora, 8.5 mm.

1 ♂. Guadalupe Island, off Lower California (E. Palmer). Dried after immersion in alcohol.

Remarkable for the entire absence of a band, which in the other Guadalupe species, *T. vinculata*, reaches the extremest dimensions.

April 5, 1876.

The President, Mr. T. T. Bouvé, in the chair. Thirty-one persons present.

The following paper was read: —

The Geological Agency of Lateral Pressure exhibited by certain Movements of Rocks. By W. H. Niles.

Probably no form of geological power has been more efficient in the formation of the fundamental features of the earth than the lateral pressure occasioned by the contraction of the globe. That the strata, yielding to this force, have been flexed and folded, and that by its action mountain chains and continents have received their elevation, is now a commonly entertained belief. While numerous well observed facts corroborate the opinion, that lateral pressure must have been one of the most constant and efficient geological agencies of the past, few have enjoyed opportunities for calmly witnessing its operations, or for quietly studying the processes of its action.

It is the object of this article to consider the evidences of the present activity of this power which are disclosed at certain localities by movements of rock and associated phenomena. For a partial description of these evidences the reader is referred to a preliminary paper upon "Some interesting Phenomena observed in Quarrying," published in the Proceedings of the Boston Society of Natural History, Vol. XIV. A further explanation of the characteristics of the force manifested has been given in a paper "On some Expansions, Movements and Fractures of Rocks, observed at Monson, Mass.," and published in the Proceedings of the American Association for the Advancement of Science, Vol. XXII, Part 2.

The observations recorded in these papers were considered as establishing the following conclusions respecting the rock at Monson: 1. That it has been brought into a compressed condition, by a powerful lateral pressure acting only in a northerly and southerly direction; 2. That when opportunity is presented, the compressed rock expands with great energy, often bending, folding and fracturing the beds, and sometimes producing sudden and violent explosions, rending and displacing the rock, and occasionally throwing stones and other debris into the air. Whether these phenomena were to be considered as local peculiarities or as manifestations of a widely distributed power was left an undecided question, with the hope that observations at other localities might determine the restriction or the distribution of this force. Some additional and important facts have been obtained at this and at some other localities, which are here presented for the purpose of considering them in connection with those already published, as evidences of the existence of a widely distributed lateral pressure now acting as a powerful geological agent.

OBSERVATIONS AT BEREA, OHIO.

Soon after the appearance of the last mentioned article in the Proceedings of the American Association, I was informed that "very similar or identical movements" were known to occur in the sandstone quarries at Berea, Ohio. Subsequently my correspondent, who modestly requests not to be quoted by name, visited the locality in search of facts, and has kindly furnished me a comprehensive description of the quarries and the phenomena. I have since visited the locality, and although the season was unfavorable for observation, enough was seen to prove the correctness of the statements I had received, and to enable me to determine some additional characteristics of the force manifested.

The fractured condition of the rock, in several places where it had been disturbed by the processes of quarrying, furnished convincing evidence of the action of some powerful agency. The peculiar characteristics of these fractures showed that they had been produced by the exercise of a force in a nearly horizontal and not in a vertical direction. At the time of my visit there was considerable ice in the quarries, and it is hence evident that the rock was not expanded at that time by the agency of heat, while the concurrent testimony of the proprietors and operators represents the movements under consideration as occurring in all states of temperature and weather. Whenever the processes of quarrying have established certain known conditions, affecting the form and extent of the undisturbed rock, as in the quarries at Monson, Mass., the force manifests itself in the phenomena produced. For an adequate representation of these conditions, some description of the locality and of the method of quarrying is necessary.

The quarries at Berea are about thirteen miles southwest of Cleveland. The rock is the Berea Grit, of the Waverley Group. Its characteristics, its geological relations and its economic value, are ably presented in the Reports of the Geological Survey of the State by Dr. J. S. Newberry, with additional descriptions of its appearance at some other localities, by his assistant, Mr. M. C. Read. The stone at Berea has a fine, homogeneous texture, and its prevailing color is gray. It is well known as a flagging and building stone, and still further by the grindstones which are extensively manufactured from it. The beds are of different thicknesses, and are nearly horizontal in position. An important part of the work of quarrying is the cutting of trenches in the beds, which are just wide enough for the men to work in. Where the quarries are well opened, these are usually cut perpendicularly into the working face. There are quarries at Berea which have an easterly and westerly working face, but I was not able to make any satisfactory observations there at the time of my visit. In the quarries here described, the course of their working faces is northerly and southerly, hence the trenches referred to in this description had an easterly and westerly course.

In contracting for this work it is necessary to stipulate that the trenches shall not be begun or deepened throughout their entire lengths at the same time. When this has been attempted, it has been found that on approaching the lower surface of a bed with a long cutting, the stone remaining at the bottom of the channel has been broken or crushed, and portions of the stone desired for use have been so fractured as to be rendered worthless. Such a method would lessen the work of the trenchers, as they are called, for they would have some of the stone broken for them without labor. But desirable as such a utilization of a geological force might be to the contracting workmen, it would be disastrous to the proprietors. It is, therefore, necessary to stipulate that the trenches shall be cut in short horizontal sections, and that each section shall be cut through to the bottom of the bed before extending the length of the channel by deepening another section. Even then the pressure is apparent and often materially assists the workmen in excavating that part of the stone in the channels which forms the lower portion of the bed. But this method prevents the laterally acting force from being greatly concentrated along any considerable portion of the lower edge of the bed, and the desirable stone is in this way saved from destruction. I give a more detailed account of the method of quarrying, for the purpose of illustrating how somewhat conflicting interests lead both workmen and proprietors to a careful and constant recognition of the existence of a natural force affecting the material with which their gains are associated, and how the nature of the force determines the method of work.

Even with this care sudden lateral slippings of the stone have frequently taken place, especially when the channels are nearly completed. These have usually been attended by cracking and explosive sounds, and sometimes the movements have been of such violence as to throw pieces of stone from the surface, or to crush portions of the rock into small fragments. In these instances it has been found that the portion of the bed which has moved has also expanded. The evidences of this expansion are decisive, for the stone permanently retains its enlarged dimensions, and the channel remains very perceptibly narrower than it was before. I am informed that there have been instances in which the expanding rock has not only closed the channel, but has also pressed against the stone which was upon the opposite side of the trench with such force that it has been broken. On one occasion the edge of the expanded portion of a bed was observed thrust over the other edge, so as to bring one portion vertically above another part of the same bed, which was originally some fifteen inches or more from it horizontally, thus producing, upon a small scale, a reversed fault. Of the lateral movements and expansions of the rock there can be no doubt, and the fact that such phenomena occur whenever like opportunities are presented must be accepted as evidence that the Berea sandstone, like the Monson gneiss, is in a state of lateral compression.

I found it to be a popular belief at the quarries that the pressure was produced by the weight of the adjacent overlying rock and loose materials, but a careful study of the facts and phenomena will convince the intelligent inquirer that the lateral compressions here exhibited could not have been caused by vertical pressure upon adjacent parts of the beds.

It being very desirable to determine whether the lateral pressure is limited in its action to a certain line of direction or not, I have taken special interest in searching for facts bearing upon this question. That the force does act in a northerly and southerly course there can be no doubt, for it is in excavating the east and west trenches, with the northern and southern ends of the beds left undisturbed, that the movements are greatest and most energetic. For an illustrative example, let us consider the conditions of a bed of rock which remains undisturbed at the eastern side of the quarry, but which has been removed from the western side, leaving a north and south working face upon the western edge of this bed. The work now to be done is to quarry the stone of that part of this bed which remains in place at the eastern side of the quarry. If an easterly trending channel is now cut in this bed at the northern side of the quarry, for example, the part of the bed south of it expands, causing a northward movement of the edge of the rock forming the southern boundary of the channel. If now another channel be cut in the same bed parallel with the first but at some distance south of it, there will be either no apparent movement of the rock north of it, or it will be much less than that which followed the cutting of the first channel, showing that the force has been partly or wholly expended. But it may be asked, why should there ever be any movement attending the formation of such a second channel? This occurs when the bed so adheres to the one below it as to prevent its complete expansion upon the formation of the first channel, hence another becomes the occasion of an additional expansion. It makes no difference in the amount of movement whether the first channel in the bed is made at the northern or southern side of the quarry; whenever the stone is freed from the adjacent rock, the force expends its energy in a northerly or southerly direction. It is also a significant fact that when the beds are traversed by excavations which trend northerly and southerly, the force does not expend itself in an easterly or westerly direction. It is only when the stone has opportunity for expansion north or south, that the compressing power to which it is subjected is fully exhibited.

It is true that when a north and south channel has been cut in the bottom bed of a quarry, fractures or movements have attended or followed the operation. Such phenomena are observed at Monson, where they are undoubtedly produced by the north and south pressure only. In these instances the lateral east and west movements of comparatively small portions of the rock are caused by the stone yielding to the pressure in such a way that portions of it are bent or thrown outward from the main bed in either an easterly or a westerly direction.

I have not yet been able to continue my observations at Berea to the extent to be desired, but at the present time I do not know of any evidences of an easterly and westerly acting pressure.

Such convincing evidence of the lateral compression of the rocks of Berea, Ohio, by a force exhibiting the same characteristics, even to the direction of its action, as the force operating upon the gneiss at Monson, Mass., is certainly highly interesting and instructive.

Before considering the geological significance and importance of these evidences, I desire to present the results of some observations made at another locality, which extend the interest attached to these.

OBSERVATIONS AT LEMONT, ILLINOIS.

At Lemont, Illinois, about twenty-six miles south-west of Chicago, there are a large number of quarries in the Niagara limestone of that region. When I visited this locality in the summer of 1864, I was informed that a curious unconformability in the position of the upper and lower parts of certain pot-holes in the rock was occasionally observed. These statements have since been recorded by Dr. Henry M. Bannister, in his report upon the Geology of Cook Co., contained in the third volume of the Reports of the Geological Survey of Illinois. So far as I know, this is the only published notice of these appearances, therefore I quote Dr. Bannister's account in full.

"It is stated that the pot-holes, which have been already mentioned as occurring in the water-worn surfaces of the upper layers in the Athens[1] quarries, when of sufficient depth to penetrate one layer and enter another, are occasionally found to be dislocated — that is, one layer has slipped upon the other, so that the upper and lower portions of the pot-hole are, in some cases, entirely separated from each other. I was not myself so fortunate as to observe a case of this kind, but the fact of their occurrence seems to be well attested. It would appear to indicate a slight disturbance of the strata, at a comparatively very recent period, subsequent even to the Terrace epoch, during which these holes were probably formed. The dip is hardly perceptible, not more than one or two degrees to the south-east, in Singer and Talcott's quarries, where these appearances have been most observed — the disturbance is, therefore, very slight, and it is quite probable that it was also very gradual."

On a recent visit to this locality, I found some interesting evidences that such a geological action is still in progress. In a quarry of the Illinois Stone Co., at Lemont, there was, Nov. 27th, 1875, an elevation of a part of the bed forming the floor of the quarry. It was an anticlinal axis of more than eight hundred feet in length, and its trend was nearly east and west. In its most conspicuous part the

[1] The stone is known as Athens marble.

elevation was from six to eight inches, and the arch measured from sixteen to eighteen feet from base to base over the crest. It was formed along the line of a vertical joint, which extends beyond the limits of the quarry. The contiguous edges of the bed were bent upward, making an elevation which was a little more upon the north side of the joint than upon the south, and a slight fault was in this way produced.

A study of the characteristics and conditions of the displacement convinced me that it was of recent origin. I subsequently had my conclusion confirmed by the testimony of a foreman in the quarry, who had been an eye-witness of the progressive formation of the interesting feature. The movement of the rock had been attended at times, he said, by explosive sounds, and sometimes fragments of the rock had been thrown into the air.

The eastern end of this little axis of elevation was where it reached the wall of rock, which forms one of the limits of the quarry. The joint extends into this rock, as above stated, but the elevation and faulting of the bed was scarcely perceptible at the base of the artificial cliff. These facts indicate that the dislocation was not caused by the weight of the adjacent overlying rock, but that the removal of the upper layers in the quarry had permitted this lower bed to yield to the pressure to which it was subjected. As the force must have acted perpendicularly to the axis of the fold, so here also we have evidence of an active lateral compression in a northerly and southerly direction.

There are other close joints running east and west in the floor of the quarry, which are likewise lines of slight displacements in the form of small faults, but the evidences of their recent origin are not so conclusive.

In one corner a channel has been excavated in the rock for the drainage of the quarry. The cutting was made by drilling two lines of nearly contiguous holes for the margins of the channel, and then removing the intervening stone. Here, also, were clear evidences of a lateral sliding, for the parts of the drill-holes remaining upon the edge of the upper layer were not vertically above the lower parts of the same holes shown upon the edge of the under bed; there was an unconformability of position like that reported of the pot-holes. Here again the facts evince the existence of a force acting in the direction of the meridian.

There can be no doubt that in quarries like those at Lemont, where large areas of unbroken rock are exposed to the sun, an expansion attends the increase of temperature. Probably certain movements, not mentioned here, are precipitated, and perhaps caused by the heating of the surface, but the origin of the phenomena designated cannot be ascribed, consistently, to changes of temperature so long as the features produced do not perceptibly vary with such changes.

OBSERVATIONS AT OTHER LOCALITIES.

I am informed by one of the proprietors of the quarry of Warren Gates' Sons at Waterford, Conn., that slight movements of the rock have been there observed under the following conditions. In using the steam drill for cutting out blocks of stone from the rock in place, if the holes are made very near each other the small portions of stone thus left between them are often crushed, and the drill so pinched that it cannot be worked. They also observe that the pressure is limited in its action to a northeasterly and southwesterly direction. The quarry is located a little east of south from Monson, at a distance of nearly sixty miles in a direct course. The stone quarried there, commercially known as Millstone Point Granite, is a gneiss, which although differing somewhat in external appearance from the Monson stone, is of similar constitution and texture, and occurs under similar geological conditions.

In the town of Groton, Conn., which is situated upon the left bank of the Thames River, opposite Waterford and New London, I observed evidences of pressure upon some thin sheets at the bottom of one of the small quarries, but the conditions did not admit of further determination. Although I have not as yet been able to give that study to this district which the importance of the subject demands, I have thought it best to present the information because it so perfectly accords with the better observed phenomena at other localities.

I would also refer again to the observations of Professor Johnston,[1] at the sandstone quarries of Portland, Conn., which led him to conclude that the "sliding of one stratum upon another" there observed, was "apparently in consequence of an immense lateral pressure," and that this pressure was in a northerly and southerly direction.

[1] Proc. Am. Assoc. Adv. Sci., Vol. VIII, p. 285.

GENERAL CONSIDERATIONS.

These manifestations of geological power under such different geographical and geological conditions lead to a further consideration of the distribution, importance and origin of this force.

The disclosure of a power at five different localities, having a geographical range of five and a half degrees of longitude, shows that it is not a local but a widely distributed force. The exact correspondence in the characteristics of the phenomena at each locality demonstrates its identity, while the fractures and displacements of rock reveal the energy of its action. A physical force so efficient and extensive in its operations must be regarded as a geological agency of great importance. While the study of flexed and dislocated strata has led to correct conceptions of the "characteristics of the force engaged," it is at least a gratification to witness its operations, especially as they so forcibly confirm the results which others have so studiously obtained. While Prof. Dana and others have already unfolded so much of the past history of this power, these phenomena demonstrate its continued activity, exhibit its agency, and enlarge our opportunities for interpreting the records of the past through the light of present events. But the geological significance of these phenomena becomes most apparent when we seek for the origin of the force.

We have already seen that the occurrence of the phenomena does not depend upon conditions of temperature or moisture, for they are observed at all seasons of the year, and during all kinds of weather. Nor can it be supposed that such changes would produce a force which should exert itself in only one line of direction. As previously indicated, no doubt such changes often coöperate with the primary power, and by assisting it to overcome resistances, precipitate the explosive movements before they might otherwise have taken place; but that there is a power, which, at times at least, is independent of all such changes, is even more distinctly observable. Nor can the existence of this power be attributed to any peculiarity in the constitution of the rocks, for it works in the same way in gneiss and sandstone, in grit and limestone. Nor can chemical or metamorphic changes be considered as the origin, for at the localities mentioned the rocks are less affected by such action than at many other places. Neither can peculiarities of geological structure or of geographical position be assigned as the determining cause; for steeply inclined and horizontal strata, the border and the interior of the continent, hill, valley and plain, furnish alike examples of its activity.

The uninterrupted existence of this force under such varying and diverse conditions shows that its cause is neither a fluctuating nor a narrowly limited one, and we therefore seek an explanation in some of the grander changes in the earth's progress.

The modern view of mountain-making by lateral movements is based upon facts which are regarded as evidences that just such events as these have occurred in the past. It will be observed that the dislocations shown in the broken, faulted, inclined and folded strata, and which enter into the fundamental features of the earth, are reproduced in miniature by this geological force of the present time, and thus it may be regarded as an exhibition of what is conceded to have been the agent of like events in the past. I am therefore convinced that the lateral compression exhibited at Monson, Berea, and other localities, is the continued action of the same geological power which has been the chief agency in the elevation of continents and mountain systems. If this conclusion is correct, and if we accept the common belief that the contraction of the globe has been the cause of the ancient movements, we may regard the present energies of the force as proceeding from the same general cause.

It does not follow, however, that the contraction of the earth must be simultaneous with the latest manifestations of the force, for the observed facts demonstrate the compressibility and elasticity of the rock, hence the compression may considerably precede the expansive movements.

But it will be observed that, at this time, the force is not exerted perpendicularly to the great mountain axes of the continent, hence the direction has been changed. But if we recall the physical history of the North American Continent we shall remember that just this change in the direction of the force was established at the close of the Tertiary, and it has determined the character and position of the subsequent elevations and subsidences. To have caused the changes of level in the northern part of the continent during the Quarternary Age, the power must have been exercised in nearly or precisely the same direction as at present, that is, parallel with the meridian. It is reasonable to expect the present operations of geological power to correspond in direction with those of the later, rather than those of the earlier periods. We may therefore reasonable claim the direction of the present actions as one of the evidences of the identity of the power.

Furthermore, although we may not at this time be able to trace a direct connection with them, yet the recent changes of level of the Atlantic Coast seem to depend upon an activity in the same north and south direction. From northern Greenland to Florida we find extents of rising coast alternating with others that are subsiding. We can better understand how these alternate areas of movement could be produced by the slight foldings, resulting from this north and south compression, than from any lateral pressure acting perpendicularly to the trend of the coast line.

It will be noticed that the more violent rendings and displacements of rock at Monson and Berea are similar to small earthquakes in their general characteristics. Many well known facts have led us to suppose that at least some of the slight earthquake shocks of this and other non-volcanic regions are caused by sudden and often loca displacements of the rock-masses which are near the surface. My observations at the quarries above mentioned teach me to look for like phenomena where the rocks are in distinct and continuous layers which are not firmly united together. Where the rocks are much divided by open joints, or are otherwise broken, the force would have little or no opportunity for manifestation. We have seen that at the localities studied the beds of rock appear to be compressed to nearly the extent of their strength for resistance, and that if the power becomes concentrated, or is slightly assisted, the layers are flexed or broken, and the more violent actions are sometimes produced. These and other associated facts demonstrate, I believe, the continual existence of a force fully adequate for the production of certain earthquake phenomena. If we accept this deduction, we may then conclude that such movements as are referred to here may often be caused, not by the sudden introduction or by the awakening of some subterranean power, but by the yielding of the rock-masses to that lateral compression to which they are continually subjected.

If this be true, the cause of a certain class of earthquake phenomena is an ever present one, only requiring favorable occasions for the manifestation of its power. It having been found that the artificial removal of comparatively small amounts of stone has caused such concentrations of this power that the adjoining rocks have been shaken and rent, we may reasonably expect that the much more extensive excavation of the strata by the natural processes of denudation would cause a still greater concentration of this force, and would thus give rise to similar but more extensive yieldings and displacements of rock, attended by more violent movements, assuming the form of genuine but local earthquakes. Thus the erosive action of streams, deepening valleys and forming gorges,[1] may in part account for the frequency of minor earthquakes in valley regions. So also the increased amount of moisture in the rocks in wet seasons and the expanding energy of the frosts of winter, may furnish sufficient assistance to enable the power to overcome the strength of the rock material, and so precipitate the violent movements as to be the occasion of the increased number of earthquakes observed in winter and during wet seasons.

In excavating hills and mountains for railroad and other constructions, explosions have sometimes occurred which could not be accounted for as the results of any artificial power. I would call attention to the evidences of a lateral compression as a probable explanation of such phenomena. I would also suggest that some of those explosions which some have supposed might have been caused by the oxydation of pyrites or other changes, may have been produced by the yielding of the rock to the force under consideration. Also strange sounds in the earth have frequently been so candidly and intelligently reported as not to be satisfactorily rejected on the supposition of fear, superstition or imagination. I would therefore suggest the possibility of some of these noises being the result of the the more gradual movements of rock, such as have been observed at the quarries above described.

Last September I was assisted by Mr. Silas W. Holman in making some careful measurements of a portion of a bed at Monson, which by expansion had formed an anticlinal arch without being broken at any point. From base to base the arch measured fifty-nine feet and nine inches. The thickness of the bed varied from ten to sixteen inches. Although after our measurements were taken the stone expanded still more before breaking, yet the amount of expansion at that time was more than one thousandth of the original length of the stone. If a thousand miles of rock were subjected to the same compression throughout, and then permitted to expand as this did, there would be an increase of one mile in its lateral extent. Mr. Holman has calculated that if one thousand miles of rock were to expand throughout its length in this proportion, causing thereby an elevation of the mass in the form of an arc of a circle, the original one thousand miles being the chord, the elevation of the centre of the

[1] G. H. Otto Volger. *Petermann's Geogr. Mittheilungen*, 1856, Heft III.

arch would then be about nineteen miles and four-tenths. I give this estimate for the purpose of showing still more conclusively that there exists in our country to-day a geological power, which, were it not confined by the rigidity of the rocks, would have sufficient energy to form hills and mountains upon as grand a scale as those which we now behold.

April 19, 1876.

The President, Mr. T. T. Bouvé, in the chair. Forty-six persons present.

The following papers were presented: —

On a Diminutive Form of Buccinum undatum ♂: — Case of Natural Selection. By Edward S. Morse.

The law of sexual selection as illustrated by Darwin, has explained the many varied features of secondary sexual characters, and the reasons for their origin and persistence. Among these features are the prehensile organs of the male, the weapons of offence and defence, ornaments of various kinds, organs for call-notes, glands for emitting odors, etc. A leading character and with few unexplained exceptions, is the frequent difference in size between the sexes.

In the struggles between males for possession, or in the struggles which often happen between males and reluctant females, the largest and more powerful males would more often win, and would more frequently perpetuate their characters as secondary sexual features. Darwin, in his "Descent of Man," has traced these marked differences in size between the sexes in crustaceans, insects, and in all classes of vertebrates.

Among certain lamellibranchiates, as Dr. Kirtland long ago observed in the Unionidæ, the difference in size and form between the male and female is oftentimes well marked, so much so, indeed, as to have led to their separation as distinct species in some cases; the female having the shell larger and more bulging posteriorly to accommodate the swollen gills when filled with eggs.

Certain gasteropods are ovoviviparous, but few, if any, observations have been made on the relative size of the sexes. Jeffreys observes that the male of *Littorina littorea* has a smoother and more slender shell, and among the Rissoas calls attention to the often marked difference in size between the sexes, the male being smaller.[1]

The usual causes for the origin and increase of secondary sexual characters could not obtain among the gasteropods. The males do not struggle among themselves for possession, and their low mental powers preclude the idea of preference and voluntary selection, by which marked features of size and of color would arise.

Among the pectinibranchiate gasteropods the male in copulation clings to that portion of the shell of the female directly above, and to one side of the genital organs, and in this position inserts the intromittant organ, having to thrust it below the margin of the shell to accomplish the act.

In Buccinum and allied forms, the female retains her hold to the rock, and from many positions assumed by the female, the sexual act can only be accomplished with an intromittant organ of extraordinary shape and size, and the curved shape and length of this organ in Buccinum bears some relation to the difficulty of approach.

The object in making this communication is to point out some curious results of natural selection on *Buccinum undatum*, within limited areas, in which the male scarcely equalled half the length of the female.

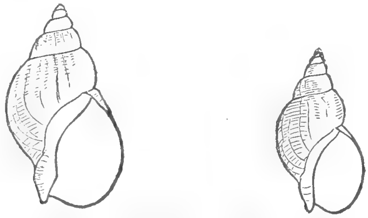
On a ledge in the harbor of Eastport, just east of the town, a small variety of *Buccinum undatum* occurs in great profusion. At the time of collecting them the sexes were pairing, and in every case (and hundreds were observed) the male was much smaller, sometimes not exceeding half the length of the female. It seemed impossible that the males could be mature, and yet they were not only found in actual connection, but an examination of the shell revealed the full number of whorls, and from other well known characters indicated the fact that they were full grown, though of diminutive size.

A glance at the condition of things at once revealed the mystery of these dwarfed males. The ledge on which these specimens were found is partly exposed at low tide, and is at all times washed by impetuous currents, so that it is quite difficult to land.

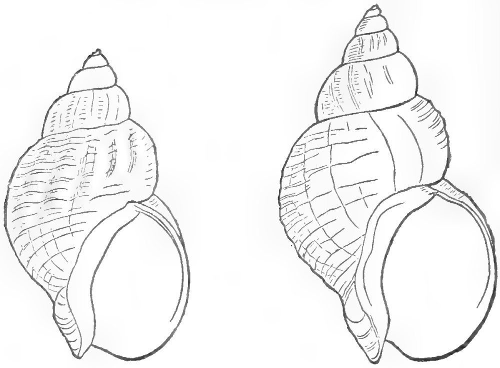
A study of the surface features of the ledge indicated the force of the tidal currents. There were no loose fragments of rock upon it, save those which were so tightly wedged in the crevices of the ledge that they could not be worked out with the hands. The specimens

[1]A more slender form of *Littorinella* (*Rissoa*) *minuta* was recognized by the lamented Prof. W. C. Cleveland as a distinct species under the name of *R. pigmenta.* He never published it, as he considered the possibility of the differences being only sexual.

of Buccinum in every case were found hid away in nooks, and concealed in the cracks and crevices marking the ledge. It was clearly obvious that only the smallest males could work their way in to such constricted quarters for the purpose of uniting with the females, and that the smaller males had the advantage over the larger males in this respect, there could be no question. The true state of the case was so instantly seen, that though hundreds of specimens were collected with the object of determining whether in any case a large male occurred, not a single exception was met with in which the female was not being fertilized by a diminutive male.



Shells of *Buccinum undatum*, male.



Shells of *Buccinum undatum*, female.

The constrained position in which these were found precluded the possibility of a large male with his cumbrous shell getting close enough to the female in her narrow quarters to perform the sexual act. The smaller males having this advantage, have from generation to generation perpetuated their dwarfed characters.

It would seem from these facts that natural selection has worked in an unusual way in producing secondary sexual characters, rarely, if ever, seen in gasteropods.

Both males and females presented a wide range of variation in the characters of the shell, some of them showing very distinctly the oblique folds so characteristic of the species, while in others these folds were scarcely visible. The shell of the male is smoother than that of the female, and is also more slender and more delicate. The figures represent normal males and females from this peculiar colony.

Critical and Historical Notes on Forficulariæ; including Descriptions of new Generic Forms and an Alphabetical Synonymic List of the Described Species. By Samuel H. Scudder.

In the tenth edition of his Systema Naturæ, Linné placed the two common species of European earwigs (*auricularia* and *minor*) in the genus Forficula, among the Coleoptera. Fabricius, in all his works, placed this genus at the head of his Ulonata (= Dermaptera DeGeer, Orthoptera auct.) following close upon the Coleoptera. Latreille, in 1796, was the first to recognize the wider separation of the earwigs from the other Dermaptera, and divided the whole order into three (unnamed) sections; of which the earwigs formed the first, Blatta the second, and the remaining Dermaptera the third. Duméril, in his Zoologie analytique (1806), recognizing the family value of the group, called it Labidoures — a name which, from its gallic dress, has no more claim upon our attention than perce-oreille. Kirby [1] subsequently maintained the ordinal character of the group, and gave it the name Dermaptera, in which he was followed in 1815 by Leach. But neither can this name be retained, since it was given by DeGeer in 1773 to the whole suborder afterward called Ulonata by Fabricius (1775), and—excluding the earwigs—Orthoptères by Olivier (1789).[2] Moreover, Latreille, recognizing it in its true character as a family of Dermaptera, had already [3] given the group the name of Forficulariæ, and this name must be retained. After tabulating the

[1] Trans. Linn. Soc. Lond., XI, 87 note (1813).

[2] By a strange oversight or neglect, the work of the distinguished Swedish naturalist, who first separated these insects from the Hemiptera of his fellow countryman Linné, has been very generally overlooked, and the term Orthoptera has been usually applied to the suborder—a name which, in its Latin form, was not proposed until 1806 by Latreille (in Sonnini's Buffon).

[3] Considerations générales sur l'order naturel des Crustacés, etc. (1810).

synonymy of this group, we will examine in alphabetical sequence each of the generic names which have been given to the different members of the family, setting forth in detail its first usage, and so far as necessary its subsequent treatment; and including in the list a few generic names now first proposed. Generic names which cannot be used are followed by an asterisk.

FORFICULARIÆ.

Labidoures ou Forficules Duméril, Zool. anal., 257 (1806).
Labidoures Serres, Ann. Mus. Hist. Nat., XIV, 65 (1809).
Labidura Burm., Germ. Zeitschr. f. Ent., II, 20 (1840).
Labidouroidæ Agass., Nomencl. Zool. Index, 199 (1846).
Forficulariæ Latr., Cons. Gén., 244 (1810).
Forficulædes Billb., Enum. Ins., 63 (1820).
Forficulidæ Steph., Syst. Cat. Br. Ins., 299 (1829).
Forficulina Newm., Ent. Mag., II, 424 (1834).
Forficulites " " " " " "
Dermaptera Kirb. (nec DeG.), Trans. Linn. Soc. Lond., XI, 87 (1813).
Dermatoptera Burm., Handb. Ent., II, 743 (1838).
Placoda Billb., Enum. Ins. 63 (1820).
Euplekoptera Westw., Zool. Journ., V, 327 (1831).
Euplexoptera Westw., Introd. Class. Ins., I, 398 (1839). (Scr. Euplectoptera Fisch., Orth. Eur, 58, note — (1858).
Harmoptera Fieb., Kelch, Orth. Obeschl., 3 (1852).

ANCISTROGASTER.

1855. Stål, Öfv. k. Vet. Ak. Förh., 349: describes a single species, *luctuosus* (from Brazil), which is therefore the type. In 1865, Dohrn, in his monograph, describes other American species allied to this, placing them all in a new world section of a larger group, which contains many species from both hemispheres. To this enlarged group he gives a new name. But even if his view of the generic affinities were correct, the name Ancistrogaster would have to be given to the whole group. (See Opisthocosmia.) The genus is confined to the tropics of the New World.

ANECHURA.

This generic name (ἀνέχω, οὐρά) is proposed for the single Fabrician species, *bipunctata.* It approaches the gerontogeic Opisthocosmia, and is remarkable for the great breadth of its thoracic sterna, and especially of the metasternum, which is broader than long. The antennæ are 11–12 jointed. The legs are long, the middle pair especially approaching the hind legs in length, at least in the female; these legs are also inserted almost, or quite as near the hind legs as the fore legs, as in certain species of Forficula proper. The abdomen is plump and dilated, and has a small tubercle on the sides of the fourth and fifth ventral segments of the male; the forceps are simple in the female, but strangely contorted in the male, bearing a superior basal tooth or angulated shoulder, beyond which the arms are curved strongly downward, and then bent backward. It belongs to Europe.

ANISOLABIS.

1853. Fieber, Lotos, III, 257: proposes this name for two European species — *maritima* and *moesta*, which are strictly congeneric. *Maritima* may be considered as the type, since it it the best known and older of these two, and on account of its being absolutely apterous, like most of the other species which must be added to the group.

No reference is made to this name in Marschall's Nomenclator Zoologicus. The genus is widespread, occurring in both hemispheres, and in Australasia. See also Forcinella and Brachylabis.

APACHYS.

1831. Serv., Ann. Sc. Nat., XXII, 35 [Apachyus]: *depressus* Pal.-Beauv. (sp.) is the only species, and therefore type.

1839. Serv., Orth., 54 [Apachya]: the same.

1846. Agass., Nom. Zool. Ind., 27: corrects the spelling as above.

Two species have since been added by Dohrn. The genus belongs to the tropics of the Old World.

APTERYGIDA.*

1839. Westw., Class. Ins., I, 406: proposes this name for Géné's section b, of Division II of Forficula,[1] including the species

[1] Saggio di una Monografia delle Forficule indigene. Padova, 1832.

with perfect tegmina but rudimentary wings, viz., *pedestris* Bon. and *decipiens* Géné[1]; the former is *albipennis* Meg., and neither of them can be generically separated from Forficula Linn-

That genus, it is true, is very large, and contains species differ. ing to a much greater extent than usual from one another, some species having, for instance, the middle pair of legs much closer to the front legs than others; but there are no grounds for separating *albipennis* from *decipiens*; and the latter species is altogether similar to *auricularia* (the type of Forficula) except in the brevity of the wings, a feature of great variability even within species in Dermaptera generally. Apterygida, then, having no *raison d'être,* must fall before Forficula. There is also an earlier generic name, Apterygia (Latr. Moll., 1825).

BRACHYLABIS.*

1864. Dohrn, Stett. Ent. Zeit.. xxv, 292, proposes this name for the following species; *mauritanica* Luc., *maritima* Bon., *angulifera* (from Guinea), *chilensis* Blanch., and *modesta* Géné.

The only character given common to both sexes, by which to distinguish this genus from his Forcinella (= Anisolabis) is the lateral plication of the second and third segments of the abdomen, which is wanting in the species grouped by him under Forcinella. In other respects, as the author acknowledges, it altogether agrees (volkommen übereinstimmend) with that group; and he further adds, that this plication is sometimes very indistinct in the species of Brachylabis, especially on the second segment. The males of Brachylabis are also stated to be peculiar in having the posterior borders of the fourth and following abdominal segments angular at the sides, and produced to a point; the females possess it to a less degree, so that when the plications are absent it is not always possible to determine into which genus a species should fall.

There is scarcely a genus of Forficulariæ in which the lateral plications of the second and third abdominal segments are not either distinctly present in all the species, or else totally absent; it is this feature, doubtless, which has led Dohrn to separate, as he has done, his two groups, Brachylabis and Forcinella; but in *maritima,* the type of his Forcinella (afterwards placed by him in Brachylabis!), we find some individuals in which the plications are tolerably distinct, while

[1] Westwood says, "three species are described," but the above are the only two.

there are others in which no trace of them whatever can be found. The species of Forcinella also (that is, those presenting no abdominal plications) vary to a considerable degree in the angular production of the sides of the abdominal segments, some in my possession surpassing in this particular the species *maritima*; so that it becomes certain that these distinctions are valueless; and as no others have been found we must group these apterous forms in a single genus whose facies is then homogeneous. Forcinella, as the older name, would then absorb Brachylabis, were it not in its turn preoccupied, as we shall see, by Anisolabis. It is possible, however, that *angulifera* or *chilensis*, or both, may be generically distinct from the other species placed in the same group by Dohrn, and in that case Brachylabis could be retained. I have seen neither of them.

CARCINOPHORA.

This name (*καρκίνος, φέρω*) is proposed for the Peruvian species which I described a few years ago under the name of *Chelidura robusta*. The genus is allied to Anisolabis, but has fewer joints in the antennæ, and the first joint of the same very long, besides perfectly formed tegmina. The head is subtriangular, much longer than broad, somewhat broader than the pronotum, tumid, the posterior angles broadly rounded; eyes pretty large; antennæ 13-jointed, the first joint as long as the space between the antennæ, slender, increasing but little in size apically, second joint no longer than broad, globular, third three times as long as broad, fourth and fifth equal, together as long as the second and third combined, the others submoniliform, subequal, about as long as the third. Pronotum flat, a little longer than broad, tapering slightly, produced apically with well rounded hind border. Tegmina as long as the pronotum, squarely docked, the sides forming an acute angle with the dorsal area; wings wanting. Legs long, compressed, the middle nearly as long as the hind pair, the middle joint of tarsi minute, but produced beneath the apical joint, not lobed. Abdomen stout, the last segment of ♀ very large, above subquadrate, below almost as long as the rest of the abdomen and triangularly produced; sides of second and third dorsal segments with but slight plication. Forceps stout, short and simple in the ♀. The female only is known to me, and the single species comes from the Peruvian Andes.

CHELIDURA.

1831. Serv., Ann. Sc. Nat., XXII, 36: uses this name for the first time in a Latin form for the single species *aptera* Charp. Previously to this the name has been used in a Gallic form (Chélidoure) by Latreille, in 1825, in his Familles naturelles (410), where neither descriptions of any sort is given, nor mention made of any species; in 1829, in the 2d Edition of Cuvier's Règne Animal (V. 173), he again uses it without species or description, excepting to make it include "ceux qui sont aptères"; the described apterous species at that time were *aptera*, *simplex* and *sinuata* — all congeneric. Serville therefore used the name in the same sense as Latreille did in its Gallic form, and *aptera* must be considered the type.

It has always been used since in the same way, whenever the species have been generically separated from Forficula. The group is confined to Europe and Madeira.

CHELISOCHES. See LOBOPHORA.

CONDYLOPALAMA.

1847. Sund., Forh. Skand. Naturf., IV, 255: proposed for a species called *agilis* found in timber brought to Stockholm from Bahia; this is therefore the type.

The "provisional" description (the only one yet given) is very meagre and unsatisfactory; but in the possession of double-jointed? (tvåledade), blunt edged forceps it is certainly most peculiar. It is said to be extremely slender, destitute of both tegmina and wings, and to be probably a larval form; to have 3-jointed tarsi, 14-jointed antennæ, and the first joint of the hind tarsi large and oval. It is further described as greyish, with a black, smooth and highly polished mesothorax, and as 5 mm. long. It is not mentioned by Dohrn.

COPISCELIS.*

1853. Fieber, Lotos, III, 257: proposes this name for the Linnean *minor*; but it falls before the earlier Labia (q. v.). Marschall's Nomenclator contains no reference to this name.

CYLINDROGASTER.

1855. Stål, Ofv. K. Vet. Ak. Förh., 350: establishes this genus upon the new species *gracilis* (from Brazil).

1858. Stål, Eug. Resa, 306: places this genus under Diplatys Serv.

This, as pointed out by Dohrn, in his Monograph, is certainly a mistake, Diplatys differing from Cylindrogaster in important particulars; Dohrn describes other species, and I have called attention in a previous paper to the characters of the female, hitherto unknown. The genus has never been found outside the limits of Brazil. This generic name has since been used in other groups of animals.

DIPLATYS.

1831. Serv., Ann. Sc. Nat., XXII, 33: proposes this name for *macrocephala* Pal.-Beauv., which is therefore the type.

It has not since been used except for the same species by Serville in his later work (Orthoptères) and by Stål, erroneously (see Cylindrogaster). Dohrn mentions it only to say that he believes he has seen a very poor specimen of the species, and promises further particulars which are not given. The species comes from W. Africa.

ECHINOSOMA.

1839. Serv., Orth., 34: founded upon the single species *afra* Pal.-Beauv.

Dohrn has since added several species. They all come from the tropics of the Old World, including northern Australia. Semper has since used this name for a group of Echinoderms.

FORCINELLA.*

1862. Dohrn, Stett. Ent. Zeit., XXIII, 226: establishes this genus in describing the species *azteca* (from Mexico), but directly specifies *Forf. maritima* Géné as the type. Notwithstanding this, while retaining Forcinella in his later Monograph, he transfers *maritima* to a new genus Brachylabis! Both of these names, however, fall before the earlier Anisolabis (q. v.). Forcinella is not included by Marschall in his Nomenclator Zoologicus.

FORFICESILA.*

1831. Serv. (ex Latr.), Ann. Sc. Nat., XXII, 32: *gigantea* Latr.

Under the Gallic name Forficésile this genus was proposed without mention of species and without further description than "ailés" by Latreille in his Familles du Règne Animal, 410 (1825). Later, in Cuvier's Règne Animal, 2e éd., V, 173 (1829), still using the French name, he refers to it the winged species with more than 14 joints to their antennæ; *gigantea* alone is specified. Serville therefore uses it wholly in the Latreillean sense. Since then (Serville, Dohrn) it has always been used in the same sense, but as *gigantea* was the type of Labidura as early as 1815, this generic name must fall before it.

FORFICULA.

1758. Linn., Syst. Nat., Ed. X, I, 423: founds the earliest of the genera of Forficulariæ upon the species described as *auricularia* and *minor*.

1810. Latr., Consid., 433, specifies *auricularia* as the type.

In this sense, whether used in a more or less restricted manner, the name has always been employed. Dohrn divides it into three sections, according to peculiarities of the male forceps; perhaps better characters would be found in the pygidium or in the relative position of the middle legs. The genus is by far the richest in species of any of the Forficulariæ, and is more widely spread than any, being found in almost every place where Forficulariæ occur, and on every continent. The genus happily retains the oldest name in the group, and has given its name to the family. Several species have been found in the European Tertiaries.

LABIA.

1815. Leach, Edinb. Encyc., IX, 118: founds this genus upon *minor* Linn., which therefore becomes the type.

Whenever since used it has always been in this sense. Serville does not refer to it in any way either in 1831 or 1839.

The genus should be placed in juxtaposition to Forficula and not be separated from it, as Dohrn has done, by the interposition of Sparatta, Chelisoches, Ancistrogaster and Opisthocosmia. It differs from Forficula principally in the simple character of its middle tarsal joint and in the shorter moniliform joints of the antennæ. It is numerous in species, and only less widely spread than Forficula, occurring probably over the entire extent of the torrid and temperate part of every continent, excepting Australia. Though abundant in all the East Indies, it has also not been brought from Oceanica. See Copiscelis. Oken proposed the generic name Labio for a group of mollusks in 1815.

LABIDOPHORA (see PLATYLABIA).

LABIDURA.

1815. Leach, Edinb. Encyl., IX, 118: bases this name upon the species *riparia* (*gigantea*), which, therefore, is the type.

Whenever since employed, it has always been in the same sense. Serville does not even refer to it, either in 1831 or 1839. Although this word in a Gallic form was proposed as early as 1806, for the whole group of earwigs, it did not receive a Latin dress (with the same scope) until 1840,[1] and therefore the present use of this word is not affected. The genus is one of the richest in species and is widely spread in the Old World, especially in the East Indies and in Europe. It has not been found in Australia. But a single species has been described as indigenous to America (Jamaica) and this may prove to be wrongly placed here, as it is an apterous species Fossil species have been found in the tertiaries of the Rocky Mountains, but these, too, should perhaps be separated from this group. See also Forficesila and Psalis.

LOBOPHORA.*

1839. Serv., Orth., 32: proposes this name for *rufitarsis* (from Java), a species since determined to be identical with the older *morio*, which is therefore the type.

The name has since been employed by several authors (Stål, Dohrn, etc.) but is preoccupied in Lepidoptera (Curtis, 1825). Chelisoches (χηλή, ὀχέω) may be used in its place. The genus is mainly, if not exclusively, confined to Australasia, including all the islands of the Indian Ocean and the neighboring main and Oceanica.

[1] See our synonymy of the family name.

MECOMERA.

1839. Serv., Orth., 53: founded upon the single species *brunnea* (from Cayenne), whlch is therefore the type. It has not been used since, and was unknown to Dohrn.

NANNOPYGIA.

1863. Dohrn, Stett. Ent. Zeit., XXIV, 60: established for a new species, *Gerstæckeri* (from Ceylon).

NEOLOBOPHORA.

1875. Scudd., Proc. Bost. Soc. Nat. Hist., XVII, 281 : established upon a species called *bogotensis* (from Bogota). Another has since been added from Mexico.

OPISTHOCOSMIA.

1865. Dohrn, Stett. Ent. Zeit., XXVI, 76: founded upon the following species: (I) *maculifera* (from Venezuela), *spinax* Dohrn, *luctuosus* Stål, *variegata* (from Venezuela); (II) *devians* (from Brazil), *centurio* (from Luzon), *armata* (from Sumatra), *forcipata* de Haan, *longipes* de Haan, *insignis* de Haan, *vigilans* Stål, *tenella* de Haan, and *ceylonica* Motsch. The first section is considered the equivalent of Stål's genus Ancistrogaster, which is thus sunk beneath a new name.

If the group as given by Dohrn is homogeneous, the name Ancistrogaster should be preserved for it; otherwise (and we believe this to be the case) Ancistrogaster (q. v.) should be retained for the species of the first section, and Opisthocosmia for those of the second. *O. devians*, however, would appear to belong rather to Ancistrogaster, and this would leave the Old World species alone to Opisthocosmia, of which *O. centurio* may be taken as the type.

PLATYLABIA.*

1867. Dohrn, Stett. Ent. Zeit., XXVIII; 347: founded upon the following species described as new: *major* (from Celebes), *thoracica* (from Penang and Ceylon), *dimidiata* (from Luzon), and *Guineensis* (from Prince Island) — all from the tropics of the Old World.

The species are all unknown to me, and therefore no type will be designated. The generic name is too close to Platylabus (Wesmael, Hym., 1845) to stand, and may be supplanted by Labidophora (λαβίς, φέρω).

PSALIDOPHORA.*

1839. Serv., Orth., 29 : proposed by Serville to supplant his earlier name Spongiphora ; the species enumerated are *Lherminieri* (from Guadaloupe), *croceipennis* Serv. and *brunneipennis* (from N. America).

The type of Spongiphora was *croceipennis*, and Serville proposes to change the name because (vid. Orth., p. 17) many entomologists had observed to him that the pad was extremely small, and could often not be seen in dried specimens. Since, however, it exists, the first name, involving no inaccuracy, should be retained. The other species added to the group in 1839, are strictly congeneric with the original species, and hence the name must be dropped. See Sphongophora.

PSALIS.

1831. Serv., Ann. Sci. Nat., XXII, 34: founded upon *americana* Pal.-Beauv., and *riparia* (*morbida*) from an unknown locality. As Serville afterwards (Orth., 20–21) points out, the generic description of the abdomen is taken from individuals which had been broken and repaired by gluing the abdomen on again *belly upward!* Many of the peculiarities of the genus are taken from features dependant upon this accident. Serville consequently believes that the name should be suppressed, and places the two species in Forficesila, between which genus and Psalis he had, in 1831, interposed two genera.

1838. Burm., Handb. d. Ent., II, 753 : uses it doubtfully for one of the sections into which he divides the single genus, Forficula, accepted by him, and places in it *americana* (*procera*) and *gagatina*; *riparia* (*gigantea*) is placed under the section Forficesila. Both on this account and because when the generic name Psalis was proposed, *riparia* was the type of Labidura (Syn. Forficesila), Psalis, if used at all, must take *americana* as its type. Dohrn places both species in the genus Labidura, and indeed at no great distance from each other. But they present so many points of structural dissimilarity that they should be generically separated.

Psalis, as represented by its type *americana*, has the following characters to contrast with those of Labidura. The short head, as pointed out by Serville, is more convex above; the antennæ are composed of fewer joints; the basal joint of the antennæ is longer and slenderer, and increases more gradually in size toward the apex; the pronotum is nearly as wide as the head; the prosternum broadens greatly and regularly in front of the legs; the legs are scarcely so slender nor so compressed; especially the fore femora are stouter; the abdomen of the female does not taper at the extremity, the last dorsal segment being quadrate, nearly as long as broad, and scarcely narrower behind than in front; while in Labidura it is transverse, nearly twice as broad in front as long, but scarcely broader behind than its length; besides, the penultimate ventral segment of Psalis ♀ leaves the sides of the last segment largely exposed; and the last segment itself is parted widely in the middle, while that of Labidura is entire. The forceps of the ♀ are much stouter in Psalis than in Labidura. Since writing the above, I find that Burmeister (Germ. Zeitschrift Ent., II, 82) has already remarked that if genera are to be separated *modo Servilleano*, *americana* and *riparia* (*gigantea*) must be placed apart.

The species of Psalis occur in the tropics of both worlds.

PYGIDICRANA.

1831. Serv., Ann. Sci. Nat., XXII, 30: proposes this name for the single species *v-nigrum* (from Brazil) which thereby becomes the type.

It has since been used by Serville, Burmeister, Stål [Pydicrana] and Dohrn in the same sense, each adding other species. Agassiz (Nom. Zool.) proposes Pygodicrana as a more correct form of the word (πυγή, δίκρανον). Burmeister (Germar Zeitschr. f. Ent., II, 79) suggests that Dicranopygia would have been better. The genus is moderately rich in species, most of which are found in the tropics of the Old World, including Australia; but two or three species are found in northern S. America.

PYRAGRA.

1831. Serv., Ann. Sc. Nat., XXII, 34: founds this genus upon the single species *fuscata* (from Cayenne), which is therefore the type. It is again employed by the author in his later work

(1839) for the same species, but does not seem to have been used since. Dohrn refers to neither genus nor species.

SPARATTA.

1839. Serv., Orth., 51: the genus is founded on *pelvimetra* (from Brazil). Other species have been added by Stål and Dohrn, all from tropical S. America.

SPONGOPHORA.

1831. Serv., Ann. Sc. Nat., XXII, 31 [Spongiphora]: proposes the name for *croceipennis* from Brazil.

1839. Serv., Orth., 29: supplants the name by that of Psalidophora, but, as we have remarked under that caption, for insufficient reasons. Guerin (Iconogr. Règne Anim., Ins. 326) referring to the very page where Serville explains his change, remarks that Serville altered the name because all Forficulariæ bore a pad between the claws! See Psalidophora.

1846. Agassiz, Nom. Zool., 349: proposes the more correct spelling Spongophora, adopted by me in 1862.

This group, under the name Psalidophora, has been used by nearly every author that has treated of the Forficularians and in the same sense. All the known species, with a single exception, come from the temperate and tropical parts of America; *S. quadrimaculata* from temperate S. Africa. I can find no points of generic distinction between a fragmentary specimen of this species and the common *S. brunneipennis* of the U. States.

TAGALINA.

1863. Dohrn, Stett. Ent. Zeit., XXIV, 44: proposes this name for two species, *Semperi* (from Luzon) and *grandiventris* Blanch.

Grandiventris, as the older species, may be taken as the type. The genus is confined to the Australasian islands. The name is unfortunately chosen from its close resemblance to Tagalis (Stål, Hem., 1860.)

THERMASTRIS.

1863. Dohrn, Stett. Ent. Zeit., XXIV, 61: proposed for *brasiliensis* Gray and *Saussurei* Dohrn, both formerly placed under Pygidicrana; two other species have since been added by myself. *Bra-*

siliensis may be chosen as the type. All the species are from the tropics of America.

TYPHLOLABIA.

This name (τυφλός, λαβίς) is proposed for the remarkable form described by Philippi from Chili under the name of *Forficula ? larva.* According to Philippi the head is as broad as long, tapering anteriorly, the angles rounded; it is altogether *eyeless*; the antennæ are *approximate* at the base, as long as the head and thorax, *30-40 jointed*, the first joint short, thick, cylindrical; the *second of equal length*, obconical, the third to the twelfth short cylindrical, the rest moniliform. Prothorax much narrower than the head, and hardly half so long; mesothorax a little broader, but narrower than the head, quadrate with rounded angles; the metathorax similar, but slightly larger. Neither tegmina nor wings are present. The legs are very short, the femora scarcely longer than the coxæ and trochanters together, the tibiæ of similar length, compressed; tarsi *one-jointed*, somewhat shorter than the tibiæ. Abdomen long and slender, the joints of about equal length, broadening up to the sixth, previous to which they are *longer than broad*; the forceps resemble those of Anisolabis, which it seems most to resemble; it is, however, exceedingly peculiar in many points of its structure, and especially in the particulars I have italicized above, in which it resembles no known Forficularians.

AN ALPHABETICAL CATALOGUE OF DESCRIBED FORFICULARIÆ; WITH OCCASIONAL BRIEF NOTES.

Ancistrogaster arthritica.

Ancistrogaster arthritica Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 253 (1876). Brazil.

Ancistrogaster devians.

Opisthocosmia devians Dohrn, Stett. Ent. Zeit., XXVI, 79 (1865). Brazil.

Ancistrogaster gulosa.

Ancistrogaster gulosa Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 263–64 (1876). Mexico.

Ancistrogaster luctuosa.

Ancistrogaster luctuosus Stål, Ofv. K. Vet. Acad. Forh., XII, 349 (1855); Ib., Eug. Resa, Zool. Ins., 306, pl. 5, fig. 1 (1858).

Opisthocosmia luctuosa Dohrn, Stett. Ent. Zeit., XXVI, 78 (1865). Brazil.

Ancistrogaster maculifera.

Opisthocosmia maculifera Dohrn, Stett. Ent. Zeit., XXVI, 77 (1865).

Forficula Petropolis Wood, Ins. Abroad, 279, fig. 138 (1874). Venezuela.

Ancistrogaster spinax.

Ancistrogaster spinax Dohrn, Stett. Ent. Zeit., XXIII, 229–30, Pl. I, fig. 1, 1*b* (1862).

Opisthocosmia spinax Dohrn, Stett. Ent. Zeit., XXVI, 78 (1865). Mexico.

Ancistrogaster variegata.

Opisthocosmia variegata Dohrn, Stett. Ent. Zeit., XXVI, 78 (1865).

Forficula appendiculata Charp., MS. [cf. Gerst., Bericht. Ent., 1855, 90–91]. Venezuela.

Anechura bipunctata.

Forficula bipunctata Fabr., Spec. Ins., I, 340 (1781); Ib., Mant. Ins., I, 224 (1787); Ib., Ent. Syst., II, 2 (1793); Gmel., Linn. Syst. Nat., I, iv, 2039 (1788); Vill., Linn. Ent., I, 427; IV, 373 (1789); Oliv., Encycl. méth., VI, ii, 467 (1792); Panz., Deutschl. Ins., H. 87, 10, fig. 10 (1802?); Burm., Handb. Ent., II, 754 (1838); Kitt., Bull. Soc. imp. nat. Mosc., XXII, 441–2, pl. 7, figs. 5–6 (1849).

Forficula biguttata Fabr., Ent. Syst., II, 2 (1793); Latr., Hist. nat. Crust. Ins., XII, 91 (1804); Ib., Gen. Crust. Ins., III, 82 (1807); Ib., Nouv. Dict. Hist. Nat., XII, 8, pl. D′, figs. 17, 17 (1817); Charp., Horæ Ent., 68 (1825); Serv., Ann. Sc. Nat., XXII, 32 (1831); Ib., Rev. méth. Orth., 5–6 (1831); Ib., Orth., 43 (1839); Géné, Monog. Forf., 12 (1832); Fisch. Wald., Ent. Russ., IV, 40–41, pl. 1, fig. 1 (1848); Kitt., Bull. Soc. imp. nat. Mosc., XXII, 439–40, pl. 7, figs. 3–4 (1849); Fisch. Fr., Orth. Eur., 72–3, pl. 6, figs. 9, 9*a–b* (1853); Friv., Orth. Hung., 47–8 (1867).

Chelidura anthracina Kolen., Melet., V, 73, pl. 17, fig. 5 (1846).

Forficula anthracina Fieb., Lotos, III, 256 (1853); Ib., Syn. Eur. Orth., 73 (1853).

Forficula Fabricii, Fieb., Lotos, III, 253–4 (1853); Ib., Syn. Eur. Orth., 70–1 (1853). Europe.

Anisolabis angulifera.

Brachylabis angulifera Dohrn, Stett. Ent. Zeit., xxv, 294 (1864). Guinea.

Anisolabis annulicornis.

Forficula annulicornis Blanch., Gay, Hist. fis. Chile, Zool., vi, 10–11 (1853); Phil., Zeitsch. ges. Naturw., xxi, 217 (1863).

Forcinella annulicornis Dohrn, Stett. Ent. Zeit., xxv, 290–1. Chili.

Blanchard says this species has rudimentary tegmina. Dohrn says it has not. Philippi says that one Chilian species is winged and he mentions this species, making some objections to Blanchard's description, but none to the statement that it has tegmina.

Anisolabis annulipes.

Forficesila annulipes Luc., Ann. Soc. Ent. Fr., Bull., 84–5 (1847).

Forcinella annulipes Dohrn, Stett. Ent. Zeit., xxv, 290 (1864).

Forficula (Labidura) annulipes Fisch. Fr., Orth. Eur., 69–70, pl. 6, fig. 6*a–c* (1853). S. Europe; Madeira.

Anisolabis Antoni.

Forcinella Antoni Dohrn, Stett. Ent. Zeit., xxv, 289–90 (1864). Venezuela.

Anisolabis azteca.

Forcinella azteca Dohrn, Stett. Ent. Zeit., xxiii, 226–7 (1862); Ib., ib., xxv, 291 (1864). Mexico.

Anisolabis Blanchardi.

Forficula Blanchardi Le Guill., Rev. Zool., 1841, 292 (1841.) Oceanica.

Anisolabis Brunneri.

Forcinella Brunneri Dohrn, Stett. Ent. Zeit., xxv, 291 (1864). Australia.

Anisolabis chilensis.

Forficula chilensis Blanch., Gay, Hist. fis. Chile., Zool. vi, 10, pl. Orth. 1, fig. 1 (1851).

Brachylabis chilensis Dohrn, Stett. Ent. Zeit., xxv, 295–6 (1864).

Forficula testaceicornis Blanch., Gay, Hist. fis. Chile, Zool., vi, 11–12 (1851). Chili.

Anisolabis colossea.

Forcinella colossea Dohrn, Stett. Ent. Zeit., xxv, 286–7 (1864).

A specimen in my collection from N. Caledonia (H. Dohrn) has no middle joint to the tarsi of one of the hind legs, though present on its mate. Australia and neighboring islands.

Anisolabis geniculata.

Chelidura geniculata Montr., Ann. Soc. Linn. Lyon [n. s.] XI, 222–23 (1864). Woodlark Isl.

This species is more closely allied to Anisolabis than to Chelidura, but apparently should be placed in a distinct genus.

Anisolabis hottentotta.

Forcinella hottentotta Dohrn, Stett. Ent. Zeit., XXVIII, 344–5 (1867). Caffraria.

Anisolabis janeirensis.

Forcinella janeirensis Dohrn, Stett. Ent. Zeit., XXV, 285–6 (1864). Brazil.

I have not seen this species, but judging from the description, it may belong to Carcinophora.

Anisolabis laeta.

Brachylabis laeta Gerst., Arch. f. Naturg., XXXV, i, 221 (1869); Ib., Glied.-Fauna Sans., 49, pl. 3, fig. 8 (1873). Zanzibar.

Anisolabis lativentris.

Forficula lativentris Phil., Zeitschr. ges. Naturwiss., XXI, 217–18 (1863). Chili.

Anisolabis littorea.

Forficula littorea White, Zool. Erebus and Terror, Insects, 24, pl. 6, figs. 4–5 (1846).

Forcinella littorea Dohrn, Stett. Ent. Zeit., XXV, 287–88. N. Zealand.

Anisolabis major.

Forficula (Forficesila) major Brullé, Webb, Hist. nat. Canaries, II, ii, Ent. 74–75 (1835–42). Canary Isl.

Is it distinct from *A. maxima*?

Anisolabis marginalis.

Forcinella marginalis Dohrn, Stett. Ent. Zeit., XXV, 288–9 (1864). Japan.

Anisolabis maritima.

Forficula maritima Bon., MS.; Géné, Monogr. Forf., 9–10 (1832); Ramb., Faun. Ent. Andal., II, 8–9 (1838).

Forficesila maritima Serv., Orth., 27–8 (1839); Luc., Expl. Alg., III, 5 (1846).

Forficula (Forficesila) maritima De Haan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 240 (1842).

Anisolabis maritima Fieb., Lotos, III, 257 (1853); Ib., Syn. Eur. Orth., 74 (1853).

Forficula (Labidura) maritima Fisch. Fr., Orth. Eur., 68, pl. 6, figs 4, 4*a–d* (1853).

Forcinella maritima Dohrn, Stett. Ent. Zeit., XXIII, 226 (1862).

Brachylabis maritima Dohrn, Stett. Ent. Zeit., XXV, 293–4 (1864).

Forficula albipes Mus. Berol. [nec Fabr.?] teste Fieber, Lotos, III.

? *Hodotermes japonicus* Hag., Proc. Bost. Soc. Nat. Hist., XI, 399–400, fig.; XII, 139 (1868).

——— ——— Savign., Descr. de l'Egypte, Planches Orth., pl. 1, fig. 6[1] (1809–13).

Europe; and thence nearly the whole world.

Dohrn says he has seen no great amount of variation in this species, although now so widely spread; I have, however, two males from S. Carolina in which the forceps entirely resemble those of the females, instead of being strongly bent inward in the middle and noticeably asymmetrical; in some specimens, too, the 13th or 14th antennal joints are bicolored, while in others they are similar to the rest; in some specimens again the posterior edge of the terminal dorsal segment of the abdomen is perfectly smooth, while in others it is puckered, as it were, being marked with short sinuous longitudinal striations; in one specimen from Nicaragua it is almost rugose.

Anisolabis mauritanica.

Forficesila mauritanica Luc., Expl. Alg., III, 4–5, pl. 1, figs. 1,–1*a–d* (1846).

Brachylabis mauritanica Dohrn, Stett. Ent. Zeit., XXV, 292 (1864).

Mauritania.

Anisolabis maxima.

Forficula (Forficesila) maxima Brullé, Webb, Hist. Nat. Canaries, II, ii. Ent. 74 (1835–42).

Forcinella maxima Dohrn, Stett. Ent. Zeit., XXV, 288 (1864).

Canary Isl.

Anisolabis moesta.

Forficula moesta Géné, MS.

Forficesila moesta Serv., Orth., 28 (1839).

Anisolabis moesta Fieb., Lotos, III, 257 (1853); Ib., Syn. Eur. Orth., 74 (1853).

Forficula (Labidura) moesta Fisch. Fr., Orth. Eur., 68–9, pl. 6, figs. 5, 5*a–d* (1853).

Forficula hispanica Herr.-Sch., Nom. Ent., Orth., 29–30 (1840).

S. Europe.

Anisolabis pacifica.

Forficula pacifica Erichs., Arch. f. Naturg., VIII, i, 247 (1842). Van Dieman's Land.

Anisolabis pectoralis.

Forficula pectoralis Eschsch., Entom., 82–3 (1822); Ib., Œuvr. Ent., I, 85–6 (1835). Kamtschatka.

Anisolabis spectabilis.

Forficula spectabilis Phil., Zeitschr. ges. Naturw., XXI, 218–19 (1863). Chili.

Anisolabis Ståli.

Forcinella Ståli Dohrn, Stett. Ent. Zeit., XXV, 286 (1864). Java.

Anisolabis taurica.

Forficula taurica Motsch., MS.

Forficesila taurica Fisch. de W., Ent. Russ., IV, 47 (1846).

Chelidura ? taurica Fisch. Fr., Orth. Eur., 70 (1853). Tauria.

Belongs next *A. moesta* unless it is a pupa.

Anisolabis varicornis.

Forficula (Brachylabis) varicornis Smith, Ann. Mag. Nat. Hist., [4] XVII, 450–51 (1876). Kerguelen Island.

Apachys chartacea.

Forficula (Apachya) chartacea de Haan, Verh. Nat. Gesch. Ned. Bezitt., Zool., 239, pl. XXIII, fig. 7 (1842).

Apachya chartacea Dohrn, Stett. Ent. Zeit., XXIV, 43–4 (1863). Malay Archipelago.

Apachys depressa.

Forficula depressa Pal.-Beauv., Ins. Afr. Amér., ii, 36–7, Pl. I, fig. 5, 5*a* (1805).

Apachyus depressus Serv., Ann. Sc. Nat., XXII, 35 (1831); Ib., Rev. méth. Orth., 9 (1831).

Apachya depressa Serv., Orth., 55 (1839); Dohrn, Stett. Ent. Zeit., XXIV, 43 (1863). W. Africa.

Apachys Murrayi.

Apachya Murrayi Dohrn, Stett. Ent. Zeit., XXIV, 44 (1863). W. Africa.

Carcinophora robusta.

Chelidura robusta Scudd., Proc. Bost. Soc. Nat. Hist., XII, 344 (1869); Ib., Ent. Notes, II, 29 (1869). Peru.

Chelidura acanthopygia.

Forficula acanthopygia Géné, Monogr. Forf., 13–14 (1832); Fieb., Lotos, III, 256 (1853); Ib., Syn. Eur. Orth., 73 (1853).

Forficula (*Chelidura*) *acanthopygia* Fisch. Fr., Orth., Eur., 83–4, pl. 6, figs. 20–20*a–d* (1853).

Chelidura acanthopygia Friv., Orth. Hung., 50–51 (1867); Dohrn, Stett. Ent. Zeit., XXVIII, 342–43 (1847).

Forficula xanthopygia Schmidt, Verz. Krain Orth.,[1] 78 (186–).

Forficula aptera Schmidt (nec Muehlf.), Verz. Krain Orth., 78 (186–).

——— ——— Savign., Descr. Egypte, Orth., pl. 1; figs. $7^{1-1'}$ (18—). Europe.

Chelidura analis.

Forficula analis Ramb., Faun. Ent. Andal., II, 10–11 (1838); Fieb., Lotos, III, 255 (1853); Ib., Syn. Eur. Orth., 72 (1854).

Forficula (*Apterygida*) *analis* Fisch., Orth. Eur., 79 (1853). Europe.

Chelidura aptera.

Forficula aptera Muehlf. MS.; Charp., Horæ Ent. 69 (1825); Aud.-Brullé, Hist. nat. Ins., IX, 29, pl. 1, fig. 2 (1835).

Chelidura aptera Serv., Ann. Sc. Nat., XXII, 36 (1831); Ib., Rev. méth. Orth., 9 (1831); Dohrn, Stett. Ent. Zeit., XXVIII, 342 (1867)

Forficula (*Chelidoura*) *aptera* Serv., Orth., 47–8 (1839).

Forficula (*Chelidura*) *simplex* Lafr. MS.; Germ. Faun. Ins. Eur., xi, pl. 17, figs. *a–c* (1824–37); Burm., Handb. Ent., II, 755 (1838); Serv., Orth., 48–9 (1839); Fisch. Fr., Orth. Eur., 82–3, pl. 6, figs. 19, 19*a–b* (1853).

Forficula simplex Fieb., Lotos, III, 256 (1853); Ib., Syn. Eur. Orth., 73 (1854).

Forficula (*Chelidura*) *dilatata* Lafr., MS.; Burm., Handb. Ent., II, 755 (1838); Fisch. Fr., Orth. Eur., 80–1, pl. 6, figs. 16, 16*a–e* (1853).

Forficula dilatata Fieb., Lotos, III, 256 (1853); Ib., Syn. Eur. Orth. 73 (1854).

Forficula alpina Géné, Monogr. Forf., 15 (1832); Fisch. Fr., Orth. Eur., 81–2 (1853); Fieb., Lotos, III, 256 (1853); Ib., Syn. Eur. Orth., 73 (1854).

Forficula montana Géné, Monogr. Forf., 14–15 (1832).

Forficula pyrenaica Géné, Monogr. Forf., 15–16 (1832); [*pyrenaea*] Herr. Schaeff., Nom. Ent. Orth., 30–1 (1840). Europe.

Chelidura Dufouri.

Forficula (*Chelidoura*) *Dufouri* Serv., Orth., 49–50, pl. 1, fig. 5, 5*a* (1839).

[1] The reference is to an extract from some work, with original pagination.

Forficula (Chelidura) Dufouri Fisch. Fr., Orth. Eur., 81, pl. 6, figs. 17, 17*a–c* (1853).

Chelidura Dufouri Dohrn, Stett. Ent. Zeit., XXVIII, 342 (1867).

Labidura vittigera Motsch., MS.

Chelidura vittigera Fisch. de W., Ent. Russ., IV, 48–49 (1846).
Europe.

Chelidura edentula.

Forficula edentula Woll., Ann. Mag. Nat. Hist., [3] I, 20 (1858).
Madeira.

Chelidura paupercula.

Forficula paupercula Géné, Monogr. Forf., 14 (1832); Fieb., Lotos, III, 257 (1853); Ib., Syn. Eur. Orth., 73 (1854).

Forficula (Chelidura) paupercula Fisch. Fr., Orth. Eur., 83 (1853).

Chelidura paupercula Dohrn., Stett. Ent. Zeit., XXVIII, 342 (1847).
Europe.

Chelidura setulosa.

Forficula setulosa Fieb., Lotos, III, 256–57 (1853); Ib., Syn. Eur. Orth., 73 (1854). Europe.

Chelidura sinuata.

Forficula sinuata Lafresn., MS.; Germ., Faun. Ins. Eur. xi, pl. 16, figs. *a–b* (1824–37); Burm., Handb. Ent., II, 755–56 (1838); Serv., Orth., 49 (1839); Fieb., Lotos, III, 256 (1853); Ib., Syn. Eur. Orth., 72–73 (1854).

Chelidura sinuata Fisch. de W., Ent. Russ., IV, 48 (1846).

Forficula (Chelidura) sinuata Fisch. Fr., Orth. Eur., 82, pl. 6, figs. 18, 18*a* (1853).

Forficula sinuata var. *macrolabia* Fieb., Lotos, III, 256 (1853); Ib., Syn. Eur. Orth., 72 (1854).

Forficula sinuata var. *cyclolabia* Fieb., Lotos, III, 256 (1853); Ib., Syn. Eur. Orth., 73 (1854). Europe.

Chelidura thoracica.

Chelidura thoracica Fisch. de W., Ent. Russ., IV, 50 (1846).

Forficula (Chelidura) thoracica Fisch. Fr., Orth. Eur., 84 (1853).
Europe (?)

This species, said by Fischer to be found in Finland (!) cannot possibly be referred to *Forficula auricularia* or *Labia minor*, the only species known from Finland.

Chelisoches albomarginatus.

Forficula (Psalidophora) albomarginata de Haan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 241 (1842).

Lobophora albomarginata Dohrn, Stett. Ent. Zeit., XXVI, 75 (1865).
Sumatra.

Chelisoches australicus.

Forficesila australica Le Guill., Rev. Zool., 1841, 292 (1841).

Forficula australica Blanch., Voy. Pole Sud., Zool. IV, 351, Orth., pl, 1, fig. 3 (1853).

Lobophora australica Dohrn, Stett. Ent. Zeit., XXVI, 72–3 (1865). New Holland.

Chelisoches comprimens.

Chelisoches comprimens Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 252–53 (1876). Africa.

Chelisoches fuscipennis.

Forficula (Psalidophora) fuscipennis de Haan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 241 (1842).

Lobophora fuscipennis Dohrn, Stett. Ent. Zeit., XXVI, 75 (1865). Sumatra.

Chelisoches laetior.

Lobophora laetior Dohrn, Stett. Ent. Zeit., XXVI, 73 (1865). Batchian.

Chelisoches Ludekingi.

Lobophora Ludekingi Dohrn, Stett. Ent. Zeit., XXVI, 73–4 (1865). Sumatra.

Chelisoches melanocephalus.

Lobophora melanocephala Dohrn, Stett. Ent. Zeit., XXVI, 75–6 (1865). India.

Chelisoches modestus.

Forficula modesta Stål, Eug. Resa, Zool. Ins., 302 (1858).

Lobophora modesta Dohrn, Stett. Ent. Zeit., XXVI, 74 (1865). China.

Chelisoches morio.

Forficula morio Fabr., Syst. Ent., 270 (1775); Ib., Spec. Ins., I, 341 (1781); Ib., Mant. Ins., I, 225 (1787); Ib., Ent. Syst., II, 5 (1793); Goeze, Ent. Beytr., I, 736 (1777); Gmel., Linn. Syst. Nat., I, iv, 2040 (1788); Oliv., Encycl. méth., VI, ii, 468 (1792); Burm., Handb. Ent., II, 752 (1838).

Lobophora morio Dohrn, Stett. Ent. Zeit., XXVI, 71–2 (1865).

Forficula (Psalidophora) rufitarsis de Haan, Verh. Nat. Gesch. Ned. Bezitt. Orth., 241 (1842).

Lobophora rufitarsis Serv., Orth., 33 (1839).

Lobophora nigronitens Stål, Eug. Resa, Zool., Ins., 305 (1858).

Lobophora tartarea Stål, Eug. Resa, Zool., Ins., 305 (1858).

Lobophora cincticornis Stål, Eug. Resa, Zool., Ins., 305 (1858).

Islands of Pacific and Indian Oceans and neighboring main.

Chelisoches simulans.

Forficula simulans Stål, Eug. Resa, Zool., Ins., 302 (1858).

Lobophora simulans Dohrn, Stett. Ent. Zeit., xxvi, 74 (1865). Malay Archipelago.

Chelisoches superbus.

Lobophora superba Dohrn, Stett. Ent. Zeit., xxvi, 71, (1865). Malay Archipelago.

Chelisoches tasmanicus.

Forficula tasmanica Blanch., Voyage Pole Sud, Zool., iv, 350–51; Orth., pl. 1, fig. 2 (1853). Tasmania.

Condylopalama agilis.

Condylopalama agilis Sund., Forh. Skand. Naturf., iv, 255 (1847). Brazil.

Cylindrogaster gracilis.

Cylindrogaster gracilis Stål, Ofv. k. Vet. Akad., Forh., xii, 350 (1855); Dohrn, Stett. Ent. Zeit., xxiv, 58–9 (1863).

Diplatys gracilis Stål, Eug. Resa, Zool., Ins., 306 (1858). Brazil.

Cylindrogaster nigra.

Cylindrogaster nigra Scudd., Proc. Bost. Soc. Nat. Hist., xviii, 251–52 (1876). Brazil.

Cylindrogaster Sahlbergi.

Cylindrogaster Sahlbergi Dohrn, Stett. Ent. Zeit., xxiv, 59 (1863). Brazil.

Cylindrogaster thoracica.

Cylindrogaster thoracicus Dohrn, Stett. Ent. Zeit., xxiv, 59 (1863). Brazil.

Diplatys macrocephala.

Forficula macrocephala Pal.-Beauv., Ins. Afr. Amér., ii, 36, pl. Orth. i, fig. 3 (1805).

Diplatys macrocephala Serv., Ann. Sc. Nat., xxii, 33 (1831); Ib., Rev. méth. Orth., 7 (1831); Ib., Orth., 51 (1839). W. Africa.

Echinosoma afrum.

Forficula afra Pal.-Beauv., Ins. Afr. Amér., ii, 35, pl. Orth. 1, fig. 1 (1805).

Echinosoma afrum Serv., Orth., 34–5 (1839); Dohrn, Stett. Ent. Zeit., xxiv, 63–4 (1863). W. Africa.

Echinosoma horridum.

Echinosoma horridum Dohrn, Stett. Ent. Zeit., xxiv, 66 (1863). Java.

Echinosoma parvulum.

Echinosoma parvulum Dohrn, Stett. Ent. Zeit., xxiv, 66 (1863). Ceylon.

Echinosoma sumatranum.

Forficula (Echinosoma) sumatrana de Haan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 241 (1842).

Echinosoma sumatranum Dohrn, Stett. Ent. Zeit., XXIV, 65 (1863). E. Indies.

Echinosoma Wallbergi.

Echinosoma Wallbergi Dohrn, Stett. Ent. Zeit., XXIV, 64–5 (1863). Caffraria.

Echinosoma Westermanni.

Echinosoma Westermanni Dohrn, Stett. Ent. Zeit., XXIV, 65–6 (1863). E. Indies.

Echinosoma Yorkense.

Echinosoma Yorkense Dohrn, Stett. Ent. Zeit., XXX, 234 (1869). N. Australia.

Forficula aculeata.

Forficula aculeata Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 262–63 (1876). Northern United States, east of the Mississippi.

Forficula africana.

Forficula africana Dohrn, Stett. Ent. Zeit., XXVI, 86–7 (1865). Africa.

Forficula albipennis.

Forficula albipennis Muehlf. MS.; Charp., Hor. Ent., 68 (1825); Burm., Handb. Ent., II, 755 (1838); Friv., Orth. Hung., 49–50 (1867); Dohrn, Stett. Ent. Zeit., XXVI, 99 (1865).

Chelidura albipennis Steph., Ill. Brit. Ent., Mand., VI, 7, pl. 28, fig. 5 (1835).

Forficula (Apterygida) albipennis Fisch. Fr., Orth. Eur., 77–8, pl. 6, figs. 14, 14 *a–b* (1853).

Forficula media Hagenb. [nec Marsh.], Symb. Faun. Ins. Helv., 16, figs. 7–8.

Forficula pedestris Bon. MS.; Géné, Monogr. Forf., 13 (1832); Serv., Orth., 45 (1839); Fieb., Lotos, III, 255 (1853); Ib., Syn. Eur. Orth., 72 (1854).

Labidura curta Motsch. MS.

Chelidura curta Fisch. de W., Ent. Russ., IV, 49 (1846).

Forficula Freyi Dohrn, Stett. Ent. Zeit., XX, 106 (1859); Meyer-Dür, Neue Denkschr. allg. Schweiz. Gesellsch., XVII, 28(1860). Europe.

Forficula albipes.

Forficula albipes Fabr., Mant. Ins., I, 224 (1787); Ib., Ent. Syst., II, 3 (1793); Gmel., Linn. Syst. Nat., I, iv, 2039 (1738); Oliv., Encyl. méth., VI, 467 (1792). W. Indies.

This species appears to be nearly allied to *F. bimaculata* Pal.-Beauv., if it be not identical with it.

Forficula ancylura.

Forficula ancylura Dohrn, Stett. Ent. Zeit., XXVI, 91–2 (1865). Phillipines.

Forficula arachidis.

Forficula arachidis Yers., Ann. Soc. Ent. France [3], VIII, 509–11, pl. 10, figs. 33–5 (1860). S. Europe.

Forficula auricularia.

Forficula auricularia Linn., Syst. Nat., ed. X, I, 423 (1758); Fabr., Syst. Ent., 269 (1775); Ib., Spec. Ins., I, 340 (1781); Ib., Mant. Ins., I, 224 (1787); Ib., Ent. Syst., II, 1 (1793); Goeze, Ent. Beytr., I, 734 (1777); Herbst., Fuessl. Arch. Ins., VII–VIII, 183 (1786); Gmel., Linn. Syst. Nat., I, iv, 2038–39 (1788); Vill., Linn. Ent., I, 425–26 (1789); Oliv., Encyl. méth., VI, ii, 466, pl. 246, fig. Forf., 1*a–c* (1792); Rossi, Fauna Etrusca, I, 316 (1795); Schrank, Faun. Boica, I, ii, 720 (1798); Marsh., Col. Brit., II, 529, pl. 30 (1802); Ib., Ent. Brit., I, 529 (1802); Panz., Deutschl. Ins., pl. 87, 8, fig. 8 (1802?); Latr., Hist. Nat. Crust. Ins., XII, 190 (1804); Ib., Gen. Crust. Ins., III, 82 (1807); Ib., Nouv. Dict. Hist. Nat., XII, 8 (1817); Leach, Edinb. Encycl., Amer. ed., VIII, 707 (1816); Ib., Zool. Misc., III, 99 (1817); Ib., Sam. Comp., 216 (1819); Zett., Orth. Suec., 36–8 (1821); Ib., Faun. Ins. Lapp., 443–44 (1828); Ib., Ins. Lapp. descr., 246 (1838); Charp., Horae Ent., 67 (1825); Dufour, Ann. Sc. Nat., XIII, 346–47, pl. 19, figs. 4–8 (1828); Phil., Orth. Berol., 56 (1830); Serv., Ann. Sc. Nat., XXII, 32 (1831); Ib., Rev. méth. Orth., 5 (1831); Ib., Orth., 36–8 (1839); Géné, Monogr. Forf., 10–12 (1832); Stevens, Ill. Brit. Ent., Mand., VI, 4–5, pl. 28, fig. 1 (1835); Aud.-Brullé, Hist. Nat. Ins., IX, 29–30, pl. 1, figs. 3, 3*a* (1835); Curt., Brit. Ent., pl. 560, No. 1, lower figures (1835–40); Ramb., Faun. Ent. Andal., II, 6 (1838); Burm., Handb. Ent., II, 753 (1838); Guer., Iconogr. Règne An., 326, pl. 52, fig. 2 (1840–44); Fisch. Wald., Ent. Russ., IV, 38–40 (1846); Luc., Expl. Alg., III, 6 (1846); Borck, Skand. Rätv., Ins. Nat. Hist., 6–11, pl. 1, fig. 1 (1848); Fisch. Fr., Orth. Eur., 74–5, pl. 6, figs. 11, 11 *a–t* (1853); Fieb., Lotos, III, 254–55 (1853); Ib., Syn. Eur. Orth., 71–2 (1854); His., Finl. Orth., 9–10 (1861); Dohrn, Stett. Ent. Zeit., XXVI, 98–9 (1865); Friv., Orth. Hung., 48–9 (1867).

Forficula auricularia var. *cyclolabia* Fieb., Lotos, III, 254 (1853); Ib., Syn. Eur. Orth., 71 (1854).

Forficula cyclolabia Schmidt, Verz. Krain Orth., 77 (186–).

Forficula auricularia var. *macrolabia* Fieb., Lotos, III, 254 (1853); Ib., Syn. Eur. Orth., 71 (1854).

Forficula macrolabia Schmidt, Verz. Krain Orth., 78 (186–).

Forficula major De Geer, Mém., III, 545–52, pl. 25, figs. 16–25 (1773); Ib., Ed. Goeze, III, 353–57, pl. XXV, figs. 16–25 (1780); Retz., Gen. Sp. Ins., 101 (1783).

Forficula parallela Fabr. Syst. Ent., 270 (1775); Ib., Spec. Ins., I, 341 (1781); Ib., Mant. Ins., I, 225 (1787); Ib., Ent. Syst., II, 4–5 (1793); Goeze, Ent. Beytr., I, 736 (1777); Gmel., Linn. Syst. Nat., I, iv, 2039 (1788); Oliv. Encycl. méth., VI, ii, 468 (1792).

Forficula media Marsh., Col. Brit., 530 (1802); Ib., Ent. Brit., I, 530 (1802); Steph., Ill. Brit. Ent., Mand., VI, 5, pl. 28, fig. 2 (1835).

Forficula neglecta Marsh., Col. Brit., II, 529–30 (1802); Ib., Ent. Brit., I, 529–30 (1802).

Forficula infumata Muehlf., MS.; Charp., Horae Ent., 70 (1825); [*strigata* sic!] Schmidt.

Forficula borealis Leach, MS.; Steph., Ill. Brit. Ent., Mand., VI, 5–6, pl. 28, fig. 3 (1835); Curt., Brit. Ent., pl. 560, No. 2, upper figure (1835–40).

Forficula forcipata Steph., Ill. Brit. Ent., Mand., VI, 6, pl. 28, fig. 4 (1835); Curt., Brit. Ent., pl. 560, No. 3 (1835–40).

Forficula lurida Fisch. Fr., Orth. Eur., 75–6, pl. 6, figs. 12 *a–b* (1853).

——— ——— Savign., Descr., de l'Egypte, Planches Orth., pl. 1, figs. 4^1, $4^{1'}$, 5^1, $5^{1'}$, $5^{\blacktriangle}$, 5^j (1809–13).

Europe, Eastern United States.

Forficula bimaculata.

Forficula bimaculata Pal. Beauv., Ins. Afr. Amér., X, 165, pl. Orth. 14, fig. 1 (1817); Serv., Ann. Sc. Nat., XXII, 32 (1831); Ib., Rev. méth. Orth., 6 (1831); Ib., Orth., 39 (1839). St. Domingo.

Serville says " antennes de dix-sept articles, selon M. de Bauvois." Beauvois himself says " dix articles aux antennes."

Forficula bolcensis.

Forficula bolcensis Mass., Stud. Pal., 15–16, pl. 1, figs. 5–7 (1856). Italy [fossil].

Forficula brachynota.

Forficula brachynota de Haan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 243, pl. 23, fig. 10 (1842); Dohrn, Stett. Ent. Zeit., XXVI, 94 (1865). E. Indies.

Forficula californica.

Forficula californica Dohrn, Stett. Ent. Zeit., xxvi, 85–6 (1865). California.

Forficula capensis.

Forficula capensis Thunb., Act. Soc. Reg. Scient. Ups., ix, 52 (1827). Cape of Good Hope.

The generic position of this insect cannot even be conjectured until the species is recovered.

Forficula cingalensis.

Forficula cingalensis Dohrn, Stett. Ent. Zeit., xxvi, 89 (1865). Ceylon.

Forficula circulata.

Forficula circulata Dohrn, Stett. Ent. Zeit., xxvi, 95–6 (1865). India.

Forficula decipiens.

Forficula decipiens Géné, Monogr. Forf., 13 (1832); Serv., Orth., 46 (1839); Fieb., Lotos, iii, 255 (1853); Ib., Syn. Eur. Orth, 72 (1854); Dohrn, Stett. Ent. Zeit., xxvi, 99 (1865).

Forficula (Apterygida) decipiens Fisch. Fr., Orth., Eur., 76–7, pl. 6, figs. 13*a*–*b* (1853).

Forficula decipiens var. *cyclolabia* Fieb., Lotos, iii, 255 (1853); Ib., Syn. Eur., Orth., 72 (1854).

Forficula decipiens var. *macrolabia* Fieb., Lotos, iii, 255 (1853); Ib., Syn. Eur., Orth., 72 (1854).

Forficula pallidicornis Brullé, Exp. Scient. Morée, iii, ii, 81 [pl. 29, fig. 2] (1832); Fieber, Lotos, iii, 254 (1853); Ib., Syn. Eur. Orth., 71 (1854). Europe.

Forficula brevis Ramb., Faun. Ent. Andal., ii, 9–10 (1838); Fieb., Lotos, iii, 255 (1853); Ib., Syn. Eur. Orth., 72 (1854).

Forficula Doumerci.

Forficula Doumerci Serv., Orth., 41 (1839). Cayenne.

Forficula elongata.

Forficula elongata Fabr., Ent. Syst., ii, 4 (1793). W. Indies.

It is possible that this may be a Spongophora.

Forficula Erichsoni.

Forficula ruficeps Erichs. [nec Burm.], Archiv. f. Nat., viii, ii, 246–47 (1842).

Apterygida Erichsoni Dohrn, Stett. Ent. Zeit., xxiii, 231 (1862). Tasmania.

Forficula erythrocephala.

Forficula erythrocephala Oliv. [nec Fabr.], Encycl. méth., VI, 468 (1792).

? *Forficula natalensis* Stål, Ofv. k. Vetensk. Akad. Förh., XII, 348 (1855). S. Africa.

Forficula exilis.

Forficula exilis Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 262 (1876). Texas.

Forficula fasciata.

Forficula fasciata Thunb., Act. Soc. Reg. Scient. Ups., IX, 52 (1827). Cape of Good Hope.

The genus to which this species should be referred is indeterminable from the description.

Forficula Fedtschenkoi.

Forficula Fedtschenkoi Sauss., Fedtsch. Turkestan, 6, pl. 1, fig. 2 (1874). Sarafschan and Ferghana.

? Forficula flavipennis.

Forficula flavipennis Fabr., Ent. Syst., II, 5 (1793). Senegal.

Forficula flexuosa.

Forficula flexuosa Fabr. Syst. Ent., 269 (1775); Ib., Spec. Ins., I, 341 (1781); Ib., Mant. Ins., I, 224 (1787); Ib., Ent. Syst., II, 3 (1793); Goeze, Beitr., I, 735 (1777); Gmel., Linn. Syst. Nat., I, iv, 2039 (1788); Oliv., Encycl., méth., VI, 468 (1792). Cayenne.

Perhaps this is *F. Percheroni* Guér.

Forficula gracilis.

Forficula gracilis Burm., Handb. Ent., II, 755 (1838). Brazil.

Forficula herculeana.

Forficula herculeana Fabr., Ent. Syst.. Suppl., 185 (1798). St. Helena.

It is impossible to tell from the description to what genus this should be referred, but the species will doubtless be recovered. Perhaps it is an Opisthoscosmia.

Forficula hirsuta.

Forficula hirsuta Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 256–57 (1876). Brazil.

Forficula Huegeli.

Forficula Huegeli Dohrn, Stett. Ent. Zeit., XXVI, 92–3 (1865). Eastern India.

Forficula Jackeryensis.

Forficula Jackeryensis Pal.-Beauv., Ins. Afr. Amér., ii, 36, pl. Orth., 1, fig. 4 (1805); Serv., Orth., 42 (1839). W. Africa.

Forficula Jagori.

Forficula Jagori Dohrn, Stett. Ent. Zeit., XXVI, 94–5 (1865). Luzon.

Forficula linearis.

Forficula linearis Eschsch., Entom., 81 (1822); Ib., Œuvr. Ent., I, 84 (1835). St. Catherina, Brazil.

Forficula lobophoroides.

Forficula lobophoroides Dohrn, Stett. Ent. Zeit., XXVI, 96 (1865). Phillippines.

Forficula Lucasi.

Forficula Lucasi Dohrn, Stett. Ent. Zeit., XXVI, 98 (1865). Syria, Egypt.

Forficula lugubris.

Forficula lugubris Dohrn, Stett. Ent. Zeit., XXIV, 230–31 (1862). Mexico.

Dohrn does not mention this species in his Monograph.

Forficula luteipennis.

Forficula luteipennis Serv., Orth., 46 (1839) [cf. Burm., in Germ., Zeitschr. f. Ent., II, 81]; Dohrn, Stett. Ent. Zeit., XXVI, 87–8 (1865).

Forficula dichroa Stål, Eug. Resa, Zool. Ins., 301 (1858). Brazil, Columbia.

Forficula luteipes.

Forficula luteipes Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 255 (1876). Brazil.

Forficula macropyga.

Forficula macropyga Westw., Royle's Himalaya, pl. 9, fig. 12 (teste Dohrn); Dohrn, Stett. Ent. Zeit., XXVI, 93 (1865). N. India.

Forficula metallica.

Forficula metallica Dohrn, Stett. Ent. Zeit., XXVI, 90–1 (1865). E. India.

Forficula minuta.

Forficula minuta Heer, Urw. d. Schweiz, 367 (1865) *ined.* Œningen [fossil].

Forficula nigripennis.

Forfiscelia (sic!) *nigripennis* Motsch., Bull. Soc. imp. Nat. Mosc., XXXVI, iii, 1–2 (1863).

Forficula nigripennis Dohrn, Stett. Ent. Zeit., XXVI, 89–90 (1865). Ceylon.

Forficula oceanica.

Forficesila oceanica Le Guill., Rev. Zool., 1841, 292 (1841).

Forficula oceanica Blanch., Voy. Pole Sud, Orth., pl. 1, fig. 4 (1853). Oceanica.

This belongs to a yet uncharacterized genus, and is not *morio* as suggested by Erichson.

Forficula Orsinii.

Forficula Orsinii Géné MS.; Fieb., Lotos, III, 254 (1853); Ib., Syn. Eur. Orth., 71 (1854); Dohrn, Stett. Ent. Zeit., XX, 107 (1859); Ib., ib., XXVI, 96 (1865).

Forficula (Apterygida) Orsinii Fisch. Fr., Orth. Eur., 79–80 (1853). Europe.

Forficula parvicollis.

Forficula parvicollis Stål, Eug. Resa, Zool. Ins., 304 (1858). Brazil.

Forficula Percheroni.

Forficula Percheron Guér., Guér. Perch., Gen. Ins., VI, iv, pl. 7 (1835–8).

Forficula Percheroni Dohrn, Stett. Ent. Zeit., XXVI, 85 (1865).

Forficula elegans Klug MS., Burm., Handb. Ent., II, 753 (1838).

Sphongophora bipunctata Scudd., Bost. Journ. Nat. Hist., VII, 415 (1862).

Psalidophora bipunctata Dohrn., Stett. Ent. Zeit., XXV, 419–20 (1864). Brazil.

The figure given by Percheron differs from the type of my *bipunctata* only in having the hind border of the prothorax more rounded, and is very probably an error of the engraver.

The specimen in the Harris Collection (presumably from Massachusetts, but, if so, very probably imported) is marked in his manuscript catalogue, "May 20, 1827. From Z. Cook, Esq."

Forficula plagiata.

Forficula plagiata Fairm., Arch. Ent., II, 257, pl. 9, fig. 3 (1858). W. Africa.

Judging from a transcript of the description and figure kindly made for me by Dr. LeConte, this seems to be a true Forficula.

Forficula primigenia.

Forficula primigenia Heer, Urw. d. Schweiz, 367, fig. 227 (1865). Œningen [fossil].

Forficula pubescens.

Forficula pubescens Géné MS.; Serv. Orth., 46–7 (1839); Fieb., Lotos, III, 255 (1853); Ib., Syn. Eur. Orth., 72 (1854); Dohrn, Stett. Ent. Zeit., XXVI, 99 (1865).

Forficula (Apterygida) pubescens Fisch. Fr., Orth., Eur., 77, pl. 6, figs. 15*a–f* (1853). Europe.

Forficula pulchella.

Forficula pulchella Serv., Orth., 42 (1839). New York.

Forficula recta.

Forficula recta Heer, Urw. d. Schweiz, 367, fig. 226 (1865). Œningen [fossil].

Forficula ruficeps.

Forficula ruficeps Burm., Handb. Ent., II, 755 (1838); Dohrn, Stett. Ent. Zeit., XXVI, 88 (1865).

Apterygida ruficeps Dohrn, Stett. Ent. Zeit., XXIII, 231–2 (1862). Mexico.

Forficula ruficollis.

Forficula ruficollis Fabr., Ent. Syst., Suppl., 185 (1798); Charp., Hor. Ent., 69 (1825); Burm. Handb. Ent., II, 754 (1838); Fieb., Lotos, III, 254 (1853); Ib., Syn. Eur., Orth., 71 (1854); Fisch. Fr., Orth. Eur., 73–4, pl. 6, figs. 10, 10*a*, *a**, *b* (1853); Dohrn, Stett. Ent. Zeit., XXVI, 97 (1865).

Forficula bœtica Ramb., Faun. Ent. Andal., II, 6–7, pl. 1, figs. 6–8 (1838). Europe.

Forficula scabriuscula.

Forficula scabriuscula Serv., Orth., 38–9 (1839). S. America.

Forficula senegalensis.

Forficula senegalensis Lefebvr. MS.; Serv. Orth., 39–40 (1839). Senegal.

Forficula serrata.

Forficula serrata Serv., Orth., 40 (1839); Dohrn, Stett. Ent. Zeit., XXVI, 97–8 (1865). Africa.

Forficula smyrnensis.

Forficula smyrnensis Serv., Orth., 38 (1839); Fieb., Lotos, III, 254 (1853); Ib., Syn. Eur. Orth., 71 (1854); Fisch. Fr., Orth. Eur., 71–2, pl. 6, figs. 8, 8*a* (1853); Dohrn, Stett. Ent. Zeit., XXVI, 96–97 (1865). Asia Minor.

Forficula speculigera.

Forficula speculigera Stål, Ofv. k. Vetensk. Akad. Förh., XII, 349 (1855). N. Grenada.

Forficula suturalis.

Forficula suturalis Serv. [nec Burm.] Orth., 40–1 (1839). Brazil.

Forficula taeniata.

Forficula taeniata Dohrn, Stett. Ent. Zeit., XXIII, 230 (1862); Ib., ib., XXVI, 85 (1865). Southern U. S. to Brazil.

Specimens (♂, ♀) taken by Mr. B. P. Mann, at São Sebastião, Brazil, agree with specimens from Mexico, except in being of a lighter color, so that the vittæ of the tegmina are not so conspicuous; they are also slightly smaller.

Forficula tolteca.

Forficula tolteca Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 261 (1876). Mexico.

Forficula vara.

Forficula vara Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 260–61 (1876). Mexico.

Forficula variana.

Forficula variana Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 253–54 (1876). Liberia.

Forficula variicornis.

Forficula variicornis Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 255–56 (1876). Brazil.

Forficula vellicans.

Forficula vellicans Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 254–55 (1876). Brazil.

Forficula Wallacei.

Forficula Wallacei Dohrn, Stett. Ent. Zeit., XXVI, 88 (1865). N. Guinea.

Forficularia problematica.

Forficularia problematica Wey., Arch. Mus. Teyl., II, 28, pl. 3, figs. 25, 26, 26*a* (1869); Ib., Ins. Foss. Bav., 28, pl. 3, figs. 25, 26, 26*a* (1869). Solenhofen [fossil].

Labia amoena.

Forficula amoena Stål, Ofv. k. Vet. Akad. Förh., XII, 350 (1855); Ib., Eug. Resa, Zool. Ins., 303–4 (1858).

Labia amoena Dohrn, Stett. Ent. Zeit., XXV, 425–26 (1864). E. Indies.

Labia annulata.

Forficula annulata Fabr., Ent. Syst., II, 4 (1793). W. Indies.

Labia arcuata.

Labia arcuata Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 257 (1876). Brazil.

Labia bilineata.

Labia bilineata Scudd., Proc. Bost. Soc. Nat. Hist., XII, 345 (1869); Ib., Ent. Notes, II, 30 (1869). Peru.

Labia brunnea.

Labia brunnea Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 264 (1876). Cuba.

Labia Burgessi.

Labia Burgessi Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 266–67 (1876).

Forficula sp., Glov., Ill. N. Am. Ent. Orth., pl. VI, fig. 19 (1872). Florida.

Labia chalybea.

Labia chalybea Dohrn, Stett. Ent. Zeit., XXV, 429 (1864). Venezuela.

Labia curvicauda.

Forfiscelia (sic!) *curvicauda* Motschl., Bull. Soc. imp. Nat. Mosc., XXXVI, iii, 2–3, pl. 2, fig. 1 (1863).

Labia curvicauda Dohrn, Stett. Ent. Zeit., 428–29 (1864). Ceylon.

Labia dilaticauda.

Forfiscelia (sic!) *dilaticauda* Motsch., Bull. Soc. imp. Nat. Mosc., XXXVI, iii, 3–4 (1863). Ceylon.

Labia dorsalis.

Forficula dorsalis Burm., Handb. Ent., II, 754 (1838). Columbia.

Labia Ghilianii.

Labia Ghilianii Dohrn, Stett. Ent. Zeit., XXV, 424–25 (1864). S. America.

Labia gravidula.

Forficula (*Apterygida*) *gravidula* Gerst., Arch. f. Naturg., XXXV, i, 221 (1869) ; Ib., Glied.-Fauna Sans., 50 pl. 3, fig. 9 (1873). Zanzibar.

Labia guttata.

Labia guttata Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 265–66 (1876). Texas.

Labia luzonica.

Labia luzonica Dohrn, Stett. Ent. Zeit., XXV, 427 (1864). E. Indies.

Labia Maeklini.

Labia Maeklini Dohrn, Stett. Ent. Zeit., XXV, 428 (1864). Brazil.

? Labia marginalis.

Forficula marginalis Thunb., Act. Soc. Reg. Scient. Ups., IX, 52 (1827).

? Forficula ochropus Stål, Ofv. K. Vetensk. Akad. Förh., XII, 348 (1855).

Labia ochropus Dohrn, Stett. Ent. Zeit., XXVIII, 345 (1867). S. Africa.

Labia melancholica.

Labia melancholica Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 267–68 (1876). Texas.

Labia minor.

Forficula minor Linn., Syst. Nat. ed. x, I, 423 (1758); De Geer, Mém., III, 553–54, pl. 25, figs. 26–7 (1773); Ib., ed. Goeze, III, 358, pl. xxv, fig. 26–27 (1780); Fabr., Syst. Ent., 269 (1775); Ib., Spec. Ins., I, 340–41 (1781); Ib., Mant. Ins., I, 224 (1787); Ib., Ent. Syst., II, 3 (1793); Goeze, Ent. Beytr., I, 735 (1777); Retz., Gen. Sp. Ins., 101 (1783); Herbst, Fuessl. Arch. Ins., VII–VIII, 183 (1786); Gmel., Linn. Syst. Nat., I, iv, 2039 (1788); Vill., Linn. Ent. I, 426–27 (1789); Oliv., Encycl. méth., VI, ii, 467–68, pl. 246, fig. Forf. 2, 2^2 (1792); Rossi, Fauna Etrusca, I, 316–17 (1795); Schrank, Fauna Boica, I, ii, 720 (1798); Marsh, Col. Brit., II, 530 (1802); Ib., Ent. Brit., I, 530 (1802); Panz., Deutschl. Ins., H. 87.9, fig. 9 (1802?); Latr., Hist. Nat. Crust. Ins., XII, 91 (1804); Ib., Gen. Crust. Ins., III, 82 (1807); Ib., Nouv. Dict. Hist. Nat., XII, 8 (1817); Zett., Orth. Suec., 38–9 (1821); Charp., Horæ Ent., 70 (1825), Phil., Orth. Berol., 6–7 (1830); Serv., Ann. Sc. Nat., XXII, 32 (1831); Ib., Rev. méth., Orth., 6 (1831); Ib., Orth., 44 (1839); Géné, Monogr. Forf., 12 (1832); Aud.-Br., Hist. Nat. Ins., IX., 30–31, pl. 1, fig. 4 (1835); Burm., Handb. Ent., II, 754 (1838); Ramb., Faun. Ent. Andal., II, 7–8 (1838); Fisch. Wald., Ent. Russ., IV, 42–4 (1846); Borck, Skand. Rätv. Ins. Nat. Hist., 11–13 (1848); Fisch. Fr., Orth. Eur., 70–71, pl. 6, figs. 7*a–d* (1853); His., Finl. Orth., 10 (1861).

Labia minor Leach, Edinb. Encycl. Am. Ed., VIII, 707 (1816); Ib., Zool. Misc., III, 99 (1817); Ib., Sam. Ent. Comp., 216–17, pl. 4, fig. 16 (1819); Steph., Ill. Brit. Ent., Mand., VI, 8 (1835); Dohrn, Stett. Ent. Zeit., XXV, 426 (1864); Glov., Ill. N. A. Ent. Orth., pl. x. fig. 3 (1872).

Copiscelis minor Fieb., Lotos, III, 257–58 (1853); Ib., Syn. Eur. Orth., 74–5 (1853).

Forficesila minor Friv., Orth. Hung., 46–7 (1867).

?Forficula livida Zschach, Mus. Lesk., 46 (1788); Gmel., Linn. Syst. Nat., I, iv, 2040 (1788).

Labia minuta Scudd., Bost. Journ. Nat. Hist., VII, 415–16 (1862); Ib., Hitchc. Geol. N. H., I, 380 (1874); Glov., Ill., N. Am. Ent., Orth., pl. I, figs. 10, 10 (1872); Prov., Nat. Can., VIII, 18–9 (1876).
Europe, N. America.

Labia mucronata.

Forficula mucronata Stål, Eug. Resa, Zool. Ins., 303 (1858).

Labia mucronata Dohrn, Stett. Ent. Zeit., xxv, 423–24 (1864).

E. Indies.

Labia pallidicornis.

Forficula pallidicornis Brullé. pl. 29, fig. 2.

Among the MSS. on Orthoptera of the late Mr. G. R. Gray (now in my possession), is a figure of this insect with the brief reference given above, which I have been unable to extend. The insect hardly appears to differ from *L. minor.*

Labia pilicornis.

Forfiscelia (sic!) *pilicornis* Motschl., Bull. Soc. imp. Nat. Mosc., xxxvi, iii, 2 (1863).

Labia pilicornis Dohrn, Stett. Ent. Zeit., xxv, 427 (1864).

Ceylon.

? Labia pygmæa.

Forficula pygmœa Fabr., Ent. Syst., ii, 3 (1793). Guinea.

Labia quadrilobata.

Labia quadrilobata Dohrn, Stett. Ent. Zeit., xxviii, 346 (1867).

Guinea.

Labia rotundata.

Labia rotundata Scudd., Proc. Bost. Soc. Nat. Hist., xviii, 263–64 (1876). Mexico.

Labia unidentata.

Forficula unidentata Pal.-Beauv., Ins. Afr. Amér., x, 165, pl. Orth. 14, fig. 3 (1817); Serv., Ann. Sc. Nat., xxii, 32 (1831); Ib., Rev. méth. Orth., 6 (1831); Ib., Orth. 41–2 (1839). St. Domingo.

Labia Wallacei.

Labia Wallacei Dohrn, Stett. Ent. Zeit., xxv, 427–28 (1864).

N. Guinea.

Labidophora dimidiata.

Platylabia dimidiata Dohrn, Stett. Ent. Zeit., xxviii, 348 (1867).

Luzon.

Labidophora guineensis.

Platylabia guineensis Dohrn, Stett. Ent. Zeit., xxviii, 348–49 (1867). Guinea.

Labidophora major.

Platylabia major Dohrn, Stett. Ent. Zeit., xxviii, 347–48 (1867).

Celebes.

Labidophora thoracica.

Platylabia thoracica Dohrn, Stett. Ent. Zeit., XXVIII, 348 (1867). E. Indies.

? Labidura advena.

Labidura advena Mein., Nat. Tidsskr., [3] v, 279–80, pl. 12, figs. 5–8, 15 (1863). Jamaica.

It is an apterous species, and appears to belong to a distinct group.

Labidura auditor.

Labidura auditor Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 252 (1876). Formosa.

Labidura castanea.

Forficesila castanea Serv., Orth., 26 (1839). Loc. ?

Labidura Dufourii.

Forficula Dufourii Desm., Faun. Franç. Orth., pl. 1, fig. 7 (1820).

Forficula pallipes Dufour (nec Fabr.), Ann. Gen. Sc. Phys., VI, 316–17, pl. 96, figs. 7, *a–b* (1820); Ramb., Faun. Ent. Andal., II, 4–6 (1838).

Labidura pallipes Dohrn, Stett. Ent. Zeit., XXIV, 317 (1863).

Forficula lividipes Dufour, Ann. Sc. Nat., XIII, 340 (1828).

Forficesila meridionalis Serv., Orth., 26–7, (1839).

Forficula (*Labidura*) *meridionalis* Fisch. Fr., Orth. Eur., 67–8, pl. 6, figs. 3, 3*a–c* (1853).

Forficula meridionalis Fieb., Lotos, III, 255 (1853); Ib., Syn. Eur. Orth., 72 (1854). Europe.

Labidura femoralis.

Labidura femoralis Dohrn, Stett. Ent. Zeit., XXIV, 321–22 (1863). Ceylon.

Labidura icterica.

Forficesila icterica Serv., Orth., 25–6 (1839). Ceylon.

Labidura indica.

Forficula (*Pygidicrana*) *indica* Hagenb. MS.; Burm., Handb. Ent., II, 751 (1838).

Forficula (*Forficesila*) *indica* DeHaan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 240 (1842).

Forficula indica Stål, Eug. Resa, Zool. Ins., 300 (1858).

Labidura indica Dohrn, Stett. Ent. Zeit., XXIV, 320–21 (1863).

Forficula geniculata Stål, Ofv. k. Vet. Akad. Förh., XII, 349 (1855). Java.

Labidura lithophila.

Labidura lithophila Scudd., Bull. U. S. Geol. Surv. Terr., II, 259–60. Colorado [fossil].

Labidura marginella.

Forficula marginella Cost., Att. R. Accad. Sc. Napoli, IV, Zool., 50–1 pl., figs. 1, 2 (1839).

Forficula (Labidura) marginella Fisch. Fr., Orth. Eur., 66–7, pl. 6, figs. 2, 2*a* (1853). Europe.

Labidura plebeja.

Labidura plebeja Dohrn, Stett. Ent. Zeit., XXIV, 284 (1863). Java.

Labidura quadrispinosa.

Labidura quadrispinosa Dohrn, Stett. Ent. Zeit., XXIV, 311 (1863). E. Indies.

Labidura riparia.

Forficula riparia Pall., Reis., II, Anh. 30 (1773); Ib., Voyages, Nouv. ed. VIII, 155–56 (1794); Goeze, Ent. Beytr., I, 735 (1777).

Forficesila riparia Fisch. Wald., Ent. Russ., IV, 46 (1846).

Labidura riparia Dohrn, Stett. Ent. Zeit., XXIV, 313–16 (1863).

Forficula pallipes Fabr., Syst. Ent., 270 (1775); Ib., Spec. Ins., I, 341 (1781); Ib., Mant. Ins., I, 225 (1787); Ib., Ent. Syst., II, 5 (1793); Goeze, Ent. Beytr., I, 736 (1777); Gmel., Linn. Syst. Nat., I, iv, 2040 (1788); Oliv., Encycl. méth., VI, ii, 468 (1792).

? *Forficula dentata* Fabr., Syst. Ent., 270 (1775); Ib., Sp. Ins., I, 341 (1781); Ib., Mant. Ins., I, 224 (1787); Ib., Ent. Syst., II, 3 (1793); Goeze, Ent. Beytr., I, 736 (1777); Gmel., Linn. Syst. Nat., I, iv, 2039 (1788); Oliv., Encycl. méth., VI, ii, 468 (1792); Thunb., Act. Soc. Reg. Scient. Ups., IX, 52 (1827).

Forficula gigantea Fabr., Mant. Ins., I, 224 (1787); Ib., Ent. Syst., II, 1–2 (1793); Gmel., Linn. Syst. Nat., I, iv, 2039 (1788); Vill., Linn. Ent., IV, 373 (1789); Oliv., Encycl. méth., VI, ii, 466 (1792); Latr., Hist. Nat. Crust. Ins., XII, 90 (1804); Ib., Gen. Crust. Ins., III, 82 (1807); Ib., Nouv. Dict. Hist. Nat., XII, 8 (1817); Charp., Horæ Ent., 67 (1825); Dufour, Ann. Sc. Nat., XIII, 345–46, pl. 19, figs. 1–3 (1828); Phil., Orth. Berol., 5 (1830); Géné, Monogr. Forf., 8–9 (1832); Brullé, Hist. Nat, Ins., IX, 28, pl. 1, fig. 1, 1*a*–*b* (1835); Brullé, Webb, Hist. Nat. Canar., II, ii, 75 (1835–42); Ramb., Faun. Ent. Andal., II, 3–4 (1838); Schaum, Peters, Reise Mozamb., II, 107 (1853).

Labidura gigantea Leach, Edinb. Encycl. Am. Ed., VIII, 707 (1816); Ib., Zool. Misc., III, 99 (1817); Ib., Sam. Ent. Comp., 217 (1819); Steph., Brit. Ent. Mand., VI, 8–9 (1835).

Forficula (Labidura) gigantea Fisch. Fr., Orth. Eur., 65–6, pl. 6, figs. 1, 1*a*–*f* (1853).

Forficesila gigantea Serv., Ann. Sc. Nat., XXII, 33 (1831); Ib., Rev. méth. Orth., 6 (1831); Ib., Orth., 23–4, pl. 1, figs. 2, 2*a* (1839); Fisch. Wald., Ent. Russ., IV, 44–5, pl. 1, figs. 1*, 1** (1846); Luc., Expl. Alg., III, 3–4 (1846); Fieb., Lotos, III, 252–53 (1853); Ib., Syn. Eur. Orth., 69–70 (1854); Friv., Orth. Hung., 45–6 (1867); Glov., Ill. N. Am. Ent., Orth., pl. x, figs. 2, 2*a* (1872).

Forficula (Forficesila) gigantea Burm., Handb. Ent., II, 751 (1838); DeHaan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 240 (1842).

Forficula bilineata Herbst, Fuessl. Archiv. Ins., VII–VIII, 183, pl. 49, fig. 1 (1788); Ib., Fuessl., Arch. Hist. Ins. 170, pl. 49, fig. 1, (1794).

Forficula maxima Vill., Linn. Ent., I, 427, pl. 2, fig. 53 (1789).

Forficula bidens Oliv., Encycl. méth., VI, ii, 466–67 (1792).

Forficula crenata Oliv., Encycl. méth., VI, ii, 467 (1792).

Forficula erythrocephala Fabr., (nec Oliv.) Ent. Syst., II, 4 (1793).

? *Forficula flavipes* Fabr., Ent. Syst., II, 2–3 (1793).

Psalis morbida Serv., Ann. Sc. Nat., XXII, 35 (1831); Ib., Rev. méth. Orth., 8 (1831).

Forficula (Forficesila) bivittata Klug. MS.; Burm., Handb. Ent., II, 751–52 (1839).

Forficula (Forficesila) suturalis Burm., Handb. Ent., II, 752 (1839).

? *Forficula bicolor* Fisch. Wald., Ent. Russ., IV, 42 (1846).

? *Forficula (Apterygida) bicolor* Fisch. Fr., Orth. Eur., 76 (1853).

Forficula Fischeri Motsch. MS.; Fisch. Wald., Ent. Russ., IV, 354 (1846).

Forficesila Fischeri Fisch. Wald., Ent. Russ., IV, 354–55, pl. 33, fig. 1 (1846).

Forficula (Forficesila) affinis Guér., Sagra, Hist. Phys. Cuba, An. Art., 330–32, pl. 12, figs. 2, 2*a* (1857).

Forficesila xanthopus Stål, Ofv. k. Vet. Akad. Förh., XII, 348–49 (1855).

Forficula xanthopus Stål, Eug. Resa, Zool. Ins., 300–1 (1858).

Forficula amurensis [ined.] Motsch., Bull. Soc. imp. Mosc., XXXII, ii, 499 (1859); Ib., Cat. Ins. Amour., 13 (1860).

——— ———. Savigny, Descr. de l'Egypte, Planches Orth., pl. 1, figs. 1^{1}, 1^{a}, 1^{i}, 1^{1-}, 1^{0}, 1^{u}, 1^{u-}, 2^{1}, $2^{1'}$, 3^{1}, $3^{1'}$, 3^{D}, 3^{d}, 3^{j} (1809–13).

There is a Labidura in the collection of the American Entomological Society (No. 54) which apparently belongs to this species, but with forceps of a remarkable character. They are as long as the abdomen (8 mm.) depressed, laminate, perfectly straight, entirely simple and tapering apically to a blunt point.

The entire Old World, whence it has spread into nearly all parts of the western hemisphere.

Labidura rufescens.

Forficula rufescens Pal.-Beauv., Ins. Afr. Amér., ii, 35, pl. Orth. 1, fig. 2 (1805).

Forficesila rufescens Serv., Orth., 24–5 (1839). W. Africa.

Labidura Servillei.

Labidura Servillei Dohrn, Stett. Ent. Zeit., XXIV, 316–17 (1863). E. India.

Labidura tarsata.

Forficula tarsata Westw., Proc. Zool. Soc. Lond., v, 129 (1837).

Labidura tarsata Dohrn, Stett. Ent. Zeit., XXIV, 311–12 (1863). Manilla.

Labidura terminalis.

Forficesila terminalis Serv., Orth., 25 (1839). Mauritius.

Labidura tertiaria.

Labidura tertiaria Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., Ser. 2, 447–49 (1876); Ib., ib., II, 259 (1876). Colorado [fossil].

Labidura Tomis.

Chelidura Tomis Kol., Melet. Ent., v, 74, pl. 17, fig. 6*a–b* (1846).

Forficula Tomis Fieb., Lotos, III, 254 (1853); Ib., Syn. Eur. Orth., 71 (1854).

Forficula Helmanni Kitt., Bull. Soc. imp. Nat. Mosc., XXII, iv, 438–39, pl. 7, figs. 1–2 (1849).

Forficula elongata Eversm, (nec Fabr.), Bull. Soc. imp. Nat. Mosc., XXXII, 123 (1859). Armenia.

I place Kolenati's and Kittary's species together on the authority of Fieber. I have not been able to consult Kolenati's plate or description, and do not know the insect in nature.

Labidura trispinosa.

Labidura trispinosa Dohrn, Stett. Ent. Zeit., XXIV, 310–11 (1863). E. India.

Labidura vicina.

Forficesila vicina Luc., Expl. Alg., III, 5–6, pl. 1, figs. 2, 2*a–e* (1846).

Labidura vicina Dohrn, Stett. Ent. Zeit., XXIV, 318–19 (1863). N. Africa, India, E. Indies.

Mecomera brunnea.

Mecomera brunnea Serv., Orth., 54 (1839). Cayenne.

Nannopygia Gerstæckeri.

Nannopygia Gerstæckeri Dohrn, Stett. Ent. Zeit., xxiv, 60–61 (1863). Ceylon.

Neolobophora bogotensis.

Neolobophora bogotensis Scudd., Proc. Bost. Soc. Nat. Hist., xvii, 282 (1875); Ib., Ent. Notes, iv, 36 (1875). Bogota.

Neolobophora volsella.

Neolobophora volsella Scudd., Proc. Bost. Soc. Nat. Hist., xviii, 237–58 (1876). Mexico.

Opisthocosmia armata.

Opisthocosmia armata DeHaan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 243, pl. 23, fig. 12 (1842).

Opisthocosmia armata Dohrn, Stett. Ent. Zeit., xxvi, 80–1 (1865). Sumatra.

? Opisthocosmia bicuspis.

Forficula bicuspis Stål, Eug. Resa, Zool. Ins., 301 (1858). Java.

Opisthocosmia centurio.

Opisthocosmia centurio Dohrn, Stett. Ent. Zeit., xxvi, 79–80 (1865). Luzon.

Opisthocosmia ceylonica.

Labia ceylonica Motsch., Bull. Soc. imp. Nat. Mosc., xxxvi, iii, 4 (1863).

Opisthocosmia ceylonica Dohrn, Stett. Ent. Zeit., xxvi, 83 (1865). Ceylon.

Opisthocosmia forcipata.

Forficula forcipata DeHaan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 242, pl. 23, fig. 11 (1842.)

Opisthocosmia forcipata Dohrn, Stett. Ent. Zeit., xxvi, 81 (1865). Sumatra.

Opisthocosmia insignis.

Forficula insignis Hagenb. MS.; DeHaan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 243, pl. 23, fig. 14 (1842).

Opisthocosmia insignis Dohrn, Stett. Ent. Zeit., xxvi, 81–2 (1865). Java.

Opisthocosmia longipes.

Forficula longipes DeHaan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 242, pl. 23, fig. 13 (1842).

Opisthocosmia longipes Dohrn, Stett. Ent. Zeit., xxvi, 81 (1865). Sumatra.

Opisthocosmia tenella.

Forficula tenella Hagenb. MS.; De Haan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 243 (1842).

Opisthocosmia tenella Dohrn, Stett. Ent. Zeit., xxvi, 82 (1865).

Java.

Opisthocosmia vigilans.

Forficula vigilans Stål, Ofv. k. Vet. Akad. Förh., xii, 350 (1855); Ib., Eug. Resa, Zool. Ins., 302–3 (1858).

Opisthocosmia vigilans Dohrn, Stett. Ent. Zeit., xxvi, 82 (1865).

Java.

Psalis americana.

Forficula americana Pal.-Beauv., Ins. Afr. Amér., x, 165, pl. Orth. 14, fig. 1 (1817).

Psalis americana Serv., Ann. Sc. Nat., xxii, 35 (1831); Ib., Rev. méth. Orth., 8 (1831).

Forficesila americana Serv., Orth., 22 (1839); Wood, Ins. Abroad, 280–81, fig. 140 (1874).

Labidura americana Dohrn, Stett. Ent. Zeit., xxiv, 319–20 (1863).

W. Indies, Central America and Northern S. America.

Psalis bengalensis.

Labidura bengalensis Dohrn, Stett. Ent. Zeit., xxiv, 312–13 (1863).

Bengal.

Psalis gagatina.

Forficula (*Psalis*) *gagathina* Klug MS.; Burm., Handb. Ent., ii, 753 (1838).

Labidura gagatina Dohrn, Stett. Ent. Zeit., xxiv, 320 (1863).

Porto Rico.

Psalis procera.

Forficula (*Psalis?*) *procera* Burm., Handb. Ent., ii, 753 (1838).

Forficula (*Forficesila*) *distincta* Guér., Sagra, Hist. Phys. Cuba, An. Art., 329–30, pl. 12, figs. 1, 1*a–b* (1857).

Forficesila elegans Stål, Ofv. k. Vet. Akad. Förh., xii, 348 (1855).

W. Indies, Central America and Northern S. America.

Psalis thoracica.

Forficesila thoracica Serv., Orth., 22–3 (1839). Cayenne.

Pygidicrana angustata.

Pygidicrana angustata Dohrn, Stett. Ent. Zeit., xxiv, 56 (1863).

Ceylon.

Pygidicrana bivittata.

Pygidicrana bivittata Erichs., Schomb. Reis. Guiana, 579–80 (1848); Dohrn, Stett. Ent. Zeit., xxiv, 48 (1863). Guiana.

Pygidicrana caffra.

Pygidicrana caffra Dohrn, Stett. Ent. Zeit., XXVIII, 343–44 (1867). Caffraria.

Pygidicrana Cumingi.

Pygidicrana Cumingi Dohrn, Stett. Ent. Zeit., XXIV, 54–5 (1863). Ceylon.

Pygidicrana Dæmeli.

Pygidicrana Dæmeli Dohrn, Stett. Ent. Zeit., XXX, 233–34 (1869). N. Australia.

Pygidicrana eximia.

Pygidicrana eximia Dohrn, Stett. Ent. Zeit., XXIV, 49–50 (1863). N. India.

Pygidicrana Kallipygos.

Pygidicrana Kallipygos Dohrn, Stett. Ent. Zeit., XXIV, 53 (1863). E. India.

Pygidicrana liturata.

Forficesila liturata Stål, Ofv. k. Vetensk. Akad. Förh., XII, 347–48 (1855).

Pygidicrana liturata Dohrn, Stett. Ent. Zeit., XXIV, 57 (1863). Caffraria.

Pygidicrana marmoricrura.

Pygidicrana marmoricrura Serv., Orth., 20 (1839); Dohrn, Stett. Ent. Zeit., XXIV, 51 (1863).

Forficula (Pygidicrana) marmoricrura deHaan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 239–40 (1842). Java.

Pygidicrana Nietneri.

Pygidicrana Nietneri Dohrn, Stett. Ent. Zeit., XXIV, 53–4 (1862). Ceylon.

Pygidicrana notigera.

Pydicrana (sic!) *notigera* Stål, Eug. Resa, Zool. Ins., 299 (1858).

Pygidicrana notigera Dohrn, Stett. Ent. Zeit., XXIV, 52 (1863). Brazil.

Pygidicrana ophthalmica.

Pygidicrana ophthalmica Dohrn, Stett. Ent. Zeit., XXIV, 55–6 (1863); Ib., ib. XXVIII, 344 (1867). Australia.

Pygidicrana pallidipennis.

Forficula (Pygidicrana) pallidipennis DeHaan, Verh. Nat. Gesch. Ned. Bezitt., Orth., 240, pl. 23, fig. 8 (1842).

Pygidicrana pallidipennis Dohrn, Stett. Ent. Zeit., XXIV, 50–1 (1863). Borneo.

Pygidicrana picta.

Pygidicrana picta Guér., Mag. Zool., VIII, pl. 236, fig. 1 (1838); Ib., Voy. Favorite, 70–71, pl. 236, fig. 1 (1838); Dohrn, Stett. Ent. Zeit., XXIV, 50 (1863). India.

Pygidicrana siamensis.

Pygidicrana siamensis Dohrn, Stett. Ent. Zeit., XXIV, 51–2 (1863). Siam.

Pygidicrana valida.

Pygidicrana valida Dohrn, Stett. Ent. Zeit., XXVIII, 344 (1867). Burmah.

Pygidicrana vitticollis.

Forficula vitticollis Stål, Ofv. k. Vet. Akad. Förh., XII, 350 (1855).

Pydicrana (sic!) *vitticollis* Stål, Eug. Resa, Zool. Ins., 299–300 (1858).

Pygidicrana vitticollis Dohrn, Stett. Ent. Zeit., XXIV, 55 (1863) China.

Pygidicrana v-nigrum.

Pygidicrana v-nigrum Serv., Ann. Sc. Nat., XXII, 31 (1831); Ib., Rev. méth. Orth., 4 (1831); Ib., Orth., 19–20, pl. 1, fig. 1, 1*a–b* (1839); Dohrn, Stett. Ent. Zeit., XXIV, 47–8 (1863).

Forficula (*Pygidicrana*) *v-nigrum* Burm., Handb. Ent., II, 751 (1838). Brazil.

Pyragra fuscata.

Pyragra fuscata Serv., Ann. Sc. Nat., XXII, 34 (1831); Ib., Rev. méth. Orth., 7 (1831); Ib., Orth., 32, pl. 1, fig. 4, 4*a–c* (1839). Guiana.

Sparatta nigrina.

Sparatta nigrina Stål, Ofv. k. Vet. Akad. Förh., XII, 350 (1855); Ib., Eug. Resa, Zool. Ins., 307 (1858); Dohrn, Stett. Ent. Zeit., XXVI, 70 (1865). Brazil.

Sparatta pelvimetra.

Sparatta pelvimetra Serv., Orth., 52–3 (1839); Dohrn, Stett. Ent. Zeit., XXVI, 68–9 (1865). Brazil.

Sparatta plana.

Forficula (*Apachys?*) *plana* Ill. MS.; Burm., Handb. Ent., II, 752 (1838).

Sparatta plana Burm., Germ. Zeitschr. f. Ent., II, 81 (1840); Dohrn, Stett. Ent. Zeit., XXVI, 69 (1865). Brazil, N. Grenada.

Sparatta rufina.

Sparatta rufina Stål, Ofv. k. Vet. Akad. Förh., XII, 350 (1855); Ib., Eug. Resa, Zool. Ins., 307 (1858); Dohrn, Stett. Ent. Zeit., XXVI, 69 (1865). Brazil.

Sparatta Schotti.

Sparatta Schotti Dohrn, Stett. Ent. Zeit., XXVI, 69–70 (1865). Brazil.

Spongophora brunneipennis.

Psalidophora brunneipennis Serv., Orth., 30–1 (1839); Dohrn, Stett. Ent. Zeit., XXV, 418–19 (1864). Eastern and Southern U. States, Arizona, Mexico.

Spongophora croceipennis.

Spongiphora croceipennis Serv., Ann. Sc. Nat., XXII, 31–2 (1831); Ib., Rev. méth., Orth., 5 (1831).

Forficula croceipennis Wils., Treat. Ins., pl. 228, fig, 6 (1835).

Forficula (Spongiphora) croceipennis Burm., Handb. Ent., II, 752–53 (1838); Guerin, Icongn. Regne Anim., 326, pl. 52, fig. 1 (184–); Gray, Griff. An. King., pl. 104, figs. 1, 1*b* (1832).

Psalidophora croceipennis Serv., Orth., 30, pl. 1, figs. 3, 3*a–b* (1839); Dohrn, Stett. Ent. Zeit., XXV, 418 (1864).

Forficula flavipennis Burm. [nec Fabr.], Handb. Ent., II, 752 (1838). Brazil.

Spongophora forfex.

Spongophora forfex Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 259 (1876). Loc.? (probably Central America.)

Spongophora frontalis.

Psalidophora frontalis Dohrn, Stett. Ent. Zeit., XXV, 422–23 (1864). Venezuela.

Spongophora insignis.

Psalidophora insignis Stål, Ofv. k. Vetensk. Akad. Förh., XII, 349 (1855). N. Grenada.

Spongophora Lherminieri.

Psalidophora Lherminieri Serv., Orth., 29–30 (1839).

Burmeister believes this to be the same as his *flavipennis* = *S. croceipennis* (cf. Germ. Zeitsch. Ent., II, 80). Guadeloupe, Brazil.

Spongophora nigripennis.

Psalidophora nigripennis Scudd., Proc. Bost. Soc. Nat. Hist., XII, 344–45 (1869); Ib., Ent. Notes, II, 29–30 (1869). Peru.

Spongophora parallela.

Forficula parallela Westw. (nec Fabr.), Guér. Mag. Zool., pl. 178 (1838).

Forficesila longissima Wood, Ins. Abroad, 279–80, fig. 139 (1874).
Central America.

Spongophora parvicollis.

Forficula parvicollis Stål, Eug. Resa, Zool. Ins., 304 (1858).

Psalidophora parvicollis Dohrn, Stett. Ent. Zeit., XXVIII, 345 (1867). Brazil.

Spongophora prolixa.

Psalidophora parallela Dohrn [nec *Forficula parallela* Westw.], Stett. Ent. Zeit., XXIII, 227–29, pl. 1, figs. 3, 3*b* (1862); Ib., ib., XXV, 418 (1864). Mexico.

Spongophora punctipennis.

Forficula punctipennis Stål, Eug. Resa, Zool. Ins., 304 (1858).

Psalidophora punctipennis Dohrn, Stett. Ent. Zeit., XXV, 421 (1864). S. America.

Spongophora pygmaea.

Psalidophora pygmaea Dohrn, Stett. Ent. Zeit., XXV, 421–22 (1864). Brazil.

Spongophora quadrimaculata.

Forficula quadrimaculata Stål, Ofv. k. Vet. Akad. Förh., XII, 348 (1855).

Psalidophora quadrimaculata Dohrn, Stett. Ent. Zeit., XXV, 420–21 (1864). S. Africa.

Spongophora stigma.

Psalidophora stigma Dohrn, Stett. Ent. Zeit., XXVIII, 345 (1867).
Venezuela.

Tagalina grandiventris.

Forficula grandiventris Blanch., Voy. Pole Sud, Zool., IV, 349–50, Orth., pl. 1, fig. 1 (1853).

Tagalina grandiventris Dohrn, Stett. Ent. Zeit., XXIV, 46 (1863).
Isle St. George (Arch. Salom).

Tagalina Semperi.

Tagalina Semperi Dohrn, Stett. Ent. Zeit., XXIV, 45 (1863).
Luzon.

Thermastris brasiliensis.

Forficula brasiliensis Gray, Griff. An. Kingd., XV, 184, pl. 78, fig. 2 (1832).

Thermastris brasiliensis Dohrn, Stett. Ent. Zeit., XXIV, 62 (1863).

Forficula (*Pygidicrana*) *opaca* Burm., Handb. Ent., II, 751 (1838).
Forficula aspera Stål, Eug. Resa, Zool. Ins., 300 (1858). Brazil.

Thermastris chontalia.

Thermastris chontalia Scudd., Proc. Bost. Soc. Nat. Hist., XVIII, 258–59 (1876). Nicaragua.

Thermastris Dohrnii.

Thermastris Dohrnii Scudd., Proc. Bost. Soc. Nat. Hist., XVII, 280–81 (1875); Ib., Ent. Notes, IV, 34–5 (1875). Peru.

Thermastris Saussurei.

Pygidicrana Saussurei Dohrn, Stett. Ent. Zeit., XXIII, 225–26, pl. 1, fig. 2 (1862).
Thermastris Saussurei Dohrn, Stett. Ent. Zeit., XXIV, 63 (1863). Mexico.

Typhlolabia larva.

Forficula ? larva Phil., Zeitschr. Ges. Naturw., XXI, 219–21 (1863). Chili.

Note. In the List of Genera the name

FORFICULARIA.

was overlooked. It was given to a fossil form by Weyenbergh in 1869 (*loc. cit.*), differing, as restored by Weyenbergh, in no respect from Forficularia.

Dr. B. Joy Jeffries, by the aid of models and diagrams, illustrated "muscular action associated with vision."

A letter from Prof. Oswald Heer, acknowledging his election as Honorary Member was read.

The gift of Hooke's Micrographia from Miss E. P. Quincy, was announced, and the thanks of the Society voted to the donor.

Annual Meeting, May 3, 1876.

The President, Mr. T. T. Bouvé, in the chair. Eighty-six persons present.

Prof. Hyatt, Custodian, presented the following report on the condition and doings of the Society during the past year.

The main object of an Annual Report is, of course, the exhibition of the progress made during the last official year. These reports are, in this respect, condensed summaries of events as they happen, and are practically useful as historical records. The inexperienced or hopeful author, however, too often regards this annual essay as his only effectual means of appealing to the outside world for the relief of pressing necessities, or, perhaps, for pecuniary assistance in carrying out new plans, until years of repeated failure gradually produce the conviction, that all such appeals are worthless; and that they neither awaken sympathy, nor bring aid of any kind.

The utter inutility of printed matter is quite remarkable. The repeated assurances conveyed in our reports, and in various published statements of the Treasurer and other officers which have from time to time appeared, have not shaken in the least degree the general belief of the community that we are a rich society. This impression continues to be held, even by those perfectly well aware of the fact that our income would barely maintain a private family in respectable comfort in this neighborhood. We are not only expected to make progress as if our income were fifty thousand instead of ten, but this same impression is nursed and kept alive in some quarters, by a spirit of criticism which is utterly regardless of the facts in the case. I am sorry to say, also, that this is not always done by inexperienced men, but often by those of greater or less scientific knowledge and acquirements, who are supposed to know something of the means at the command of the Society, and to be able to judge of the propriety or impropriety of the expenditures. It is strange that those who have so much to lose by the weakening of the influence and importance of scientific institutions should not be more cautious and considerate in what they say about them.

A very marked instance of this has occurred since this was written, but fortunately in so public a manner that the want of truthfulness and honesty in the whole criticism was easily exposed.

I will now pass on to the proper subject of my Report, the history of the last official year.

An event, which, in its results, was very satisfactory to the officers of this Society, occurred at the meeting when the present President, Mr. T. T. Bouvé, offered his resignation. I allude to the approbation of the policy which had governed the Society during his presidency, expressed by many of our most influential members. The officers of the Society felt themselves to be identified with the President in this matter; and, consequently, the ovation which he received, and the absolutely unanimous vote of a large and select meeting of the Society, requesting him to withdraw his resignation, were peculiarly grateful to them.

Mr. Bouvé, in what were intended as his valedictory remarks, most generously attributed to me the authorship of the plan of operations by which the Society had been governed during his administration, but did not do himself full justice in this and subsequent statements. If he, as President, had listened to the advice of several of the most experienced members of this Society, naturally his most reliable and trusted advisers, we should to-day, as in former years, have had no settled policy, and no plan would have been in existence. Fortunately, he preferred to judge of all matters presented to the Council upon their intrinsic merits; and the results have more than justified this course. It has been successfully demonstrated that the heterogeneous elements of a Society like ours can be united upon a common policy, and both move and act more effectually in consequence. I could readily dilate upon this theme, but do not feel disposed to obscure the fact that a movement of great importance to the future interests of science in America has been successfully accomplished, by means of the influence and independent judgment of our chief administrative officer.

Early in October the Council, in response to a communication from the Agent of the Centennial Commissioners of the

State of Massachusetts, appointed a committee, consisting of the President, Mr. John Cummings, and the Custodian, to determine in what manner, if any, the Society should be represented at the Centennial Exposition. This committee drew up a set of propositions, a copy of which is appended to this Report, and submitted them to the Commissioners. They were received by Mr. Leverett Saltonstall, Mr. Meigs, and Mr. Hill, the three members of the State Commission, with the most earnest approbation. Various causes, which it would now be a loss of time to discuss, prevented definite action until after the 1st of March. Then, although the whole amount of the appropriation at first asked for was offered by Governor Rice, it had become too late to attempt the formation of the necessary collections. This failure was much to be regretted, since the Society thereby lost an opportunity of showing to the whole country the kind of work a Museum of this class ought to do, and how its collections could be made of use as part of the public educational system of the State.

While negotiating with the Commissioners the Custodian agreed to prepare a Geological Map of New England, as a part of the New England department in the Society's exhibition. Finally, at the request of the Commission, this was undertaken independently, and a separate sum appropriated for its execution. This map was entrusted to Mr. Crosby, by whom it has been compiled. It is based upon Edward Hitchcock's wall-map of 1841, but differs considerably from that, and from that of C. H. Hitchcock in Walling's Atlas. Many of the outlines are very much changed, and a very different translation given to the lithological structure of several portions of the State. The object in view, namely, the representation of the changes made in our views of the structure of the State by more recent observations, has been fairly accomplished, notwithstanding the shortness of the time allowed for the work. A text will accompany the map, describing the results in a brief form, and acknowledging our indebtedness to the various authors, from whose published or original works it has been constructed.

CONDITION OF THE COLLECTIONS.

Mr. Bouvé, as Chairman of the Committee on Mineralogy, reports that the collection remains in its former good condition. It has received some accessions during the year by the purchase of some desirable specimens from the Jackson Collection. It now consists of 3,230 trays and single specimens, of which 347 are in the New England collection. These are largely selected specimens, many of them of exceptional excellence and value.

The Geological Collection has been nearly completed by the same gentleman, and will be opened to the public within a short time. A full account of the mode of arrangement will therefore be deferred until the next Annual Report.

Mr. Crosby's time has been, of course, largely taken up by the preparation of the Geological Map, above described, and this has interrupted the progress of the mounting of the Paleontological Collection, which was going on under his direction. Miss Carter has, however, finished the fossils of the Tertiary formation, in the European Collection, and Miss Washburn a considerable number of the American fossils; and this work will probably be speedily resumed.

The work on the Botanical Collection, under the charge of Mr. Cummings, has been going on steadily, although this gentleman's increased public duties have prevented him from giving us so much of his own time as in former years. The New England Collection has been completed, poisoned, and catalogued by Miss Carter, and is now ready for exhibition. It contains *nearly* every species found within the borders of the New England States and in most cases, two specimens of a species. There are 1984 species and 3227 specimens. The "Lowell Collection" is being poisoned and catalogued, one-third of it being already finished. Nearly one-half of the

"General Collection" has also been catalogued and arranged.

The preparations of the leaves and stems of New England trees and shrubs, described in the last Annual Report, have been placed on exhibition by the donor, Mr. Edward T. Bouvé. They fill, together with the accompanying specimens of wood-sections, one entire gallery. They are also accompanied by a series of the plates from the last edition of "The Trees and Shrubs of Massachusetts," presented by Mr. Geo. B. Emerson, showing the natural colors of the leaves, flowers, and fruit. Altogether this collection must be considered one of the most attractive and instructive in the Museum, and the Society owes its most earnest thanks to the donor.

Miss Washburn has been employed during the greater part of the winter in cataloguing the Bailey Microscopical Collection. The labels, and entries on the labels, and loose manuscript slips accompanying the slides, have been, for the most part, entered by Miss Washburn in our running catalogue, and the incomplete descriptive Bailey Catalogue carried out and completed. Dr. Henry Coleman has continued his work upon the Burnett Collection of mounted parasites. These have also, in common with our general collection of microscopical material, been catalogued by Miss Washburn.

The arrangement of the Wyman Anatomical Collection, and its incorporation with our own, has been finished by Dr. Thomas Dwight, and reported upon by him to the Society, in the Proceedings for October 20, of the present year. The Chairman of the Committee further reports that many sections showing the structure of bones have been prepared by him and added to the collection during the year, and also that the skeletons of a large sea-lion and of two fur-seals have been acquired through the liberality of Capt. Charles Bryant, the Superintendent in charge of the Fur-Seal Islands.

The Palmer collection of Florida sponges has been acquired by purchase, and now forms the beginning of our new collection of Protozoa. Very valuable, though small, collections of Australian sponges have also been received from Dr. W. G. Farlow and others, so that the Society now possesses the finest dried collection of these animals in this country.

The Custodian spent the past summer with the Fish Commission, under the charge of Prof. S. F. Baird, at Wood's Hole. Here he enjoyed the facilities previously described in these reports, and considerably enlarged the New England Collection, for which the Society is indebted to the kindness of Prof. Baird, the United States Commissioner, and Prof. A. E. Verrill, Assistant in charge of the Zoological Department. The appointment of Mr. R. Rathbun as Assistant in the Royal Geological Commission of Brazil deprived the Society of his services at a time when they were most needed, and cut short the improvements which were so rapidly being made by him in the New England Collection. The Custodian was assisted in the summer work for a portion of the time by Mr. Simonds of Cornell; but this gentleman, also, received before the close of the season the offer of a more desirable position, and returned to Ithaca as Assist. Prof. in Paleontology. Several models of the Mollusca were begun by Mr. Rathbun and one was nearly finished by Mr. Simonds. These have been completed by Dr. W. K. Brooks, Assistant in the Museum, and a number of new ones added. One of these, a very handsome model of *Sycotypus canaliculatus* Gill (*Busycon canaliculatum* Stimpson), represents a donation by Mr. R. C. Greenleaf, whose gifts enabled me to initiate the making of these models. Dr. Brooks has also begun the preparation of an accompanying suite of anatomical preparations for each model. At his suggestion, also, an important addition has been made, consisting of suites of models showing the principal stages in the development of the characteristic types of the Mollusca. Several families have now each their model and anatomical preparations of the animal, and the type forms of the generic groups have been picked out and are shown as in the specimens exhibited in the case upon the table. Dr. P. P. Carpenter has continued the the work on the classification and labelling of the shells, and has completed all the larger genera of marine shells and the very difficult group of Melanians, and all the remaining fresh-water genera, except the Pulmonates and the genera Cyclostoma and Helicina.

All the Annelids have been reviewed, sorted, and the Entozoa named by the Custodian, and the work will be continued until it is finished.

The Insects have received considerable attention at the hands of Mr. S. Henshaw, who reports through the Chairman of the Committee, Mr. S. H. Scudder, that the entire collection, including the general collection, the Harris, Dale and Atkinson bequests, has been examined and is free from Anthreni, only two living larvæ having been found. The North American specimens in the boxes covered with paper have been arranged in glass-covered drawers, and the boxes containing the foreign specimens re-covered and their contents noted. The North American Coleoptera have been arranged, by families, in glass-covered drawers. The New England collection of Coleoptera has been arranged as far as the Buprestidæ, but only placed on exhibition as far as the Trichopterygidæ, according to Crotch's Check-List. This includes six families, of which 457 species are known to occur in New England, and of these 327 species are on exhibition, all — with a few exceptions — New England specimens.

Mr. Van Vleck has been employed two days in each week in the general work of the Museum, during the past winter. He has also been occupied with the Fishes. All the generic types have been picked out and these will form the basis of our systematic collection, which it will probably not be very difficult to fill out. The Epitome collection of fishes has also been picked out by the same gentleman, and the duplicates and reserve collections sorted. Mr. Garman, of the Museum of Comparative Zoology, has been kind enough to look over and name a portion of our reptiles, and it is hoped that he will be able to complete this portion of our Museum during the coming year.

Our collection of Mammalia may be said to have been begun by the presentation of a fine Polar Bear by Bishop Williams, the skin of the famous greyhound "Brownie," by Mr. Addison Child, and a specimen of the celebrated breed of Ancon sheep by Mr. Geo. W. Bond.

Considerable assistance has been received during the year from the voluntary labors of Mr. Edward G. Gardiner, whose services have enabled us to carry on some advantageous exchanges and attend to a number of details which must otherwise have been neglected.

The Ornithological Collection remains in its usual good but dormant condition.

IMPROVEMENTS IN THE BUILDING.

During the year one more room has been fitted up with the improved cases and brackets for the reception of the New England fishes, reptiles, birds and mammals. The building has been improved by the introduction of a larger service pipe, which now gives an ample supply of water, and every workroom is fitted with screw faucets. One large faucet with hose attached is always ready in the cellar, in case of fire, and three other sets of hose are distributed about the building for use, in case of necessity, in the workrooms. On the roof there are two more faucets, one on either wing, to which hose can be attached in case it is required in that quarter. Besides these precautions, buckets of water are kept in each workroom, accompanied by a Johnston pump, and three of the patent gas machines stand ready for use at three different points of the building. By these precautions three different means of extinguishing fire are placed within reach of any one who may first perceive it.

LABORATORY.

The condition of the Laboratory, in which the Institute of Technology and the Society are mutually interested, continues steadily to improve under the management of Mr. Crosby. The collections have been increased by the purchase of a few essential specimens by the Institute. The fossils have been rearranged so that things begin to assume a more permanent aspect. This Laboratory and the collection have also been used more or less by four female students, in addition to the usual number of students from the Institute. In this way it has been made useful to a very important and earnest movement for the diffusion of knowledge among women through the means of study offered to one of these female pupils.

TEACHERS' SCHOOL OF SCIENCE.

The Teachers' School of Science has been carried on as before, by the liberality of Mr. Cummings. Fourteen lectures or practical lessons in Lithology have been given by Mr. L. S. Burbank, during the past winter; the average attendance was about ninety out of one hundred members. This is a remarkable fact, when we consider that the class includes a large number of the busiest teachers, the Masters of the Public Schools of Boston and the vicinity. Each member of the class was provided with tools consisting of small hammer, magnet, file, streak stone of Arkansas quartzite, a bottle of dilute acid with rubber stopper and glass rod and the scale of hardness previously used in the Mineralogical course. All these were purchased by the members of the class, except the scale of hardness, which is retained for future use. One hundred sets of about seventy-five specimens each, were distributed. Most of these were large enough for cabinet specimens, and many of the sets have been placed in the collections of the city schools and used in the instruction of the pupils. The specimens were largely collected in this State, and the rocks of the Connecticut valley and the western part of the State were very fully represented. The course is now being supplemented by a series of excursions for field work in the vicinity of Boston, voluntarily conducted by Mr. Burbank.

Seventy-five per cent. of the class this year were members of the last year's class in Mineralogy, and the great success of this year's work has been a matter of sincere congratulation, and justifies the most sanguine anticipations on the part of the projectors of this effort to introduce the study of Natural History into the Common Schools.

APPENDIX.

The following propositions to the Massachusetts Centennial Commission, Department of Education and Science, were made by the Boston Society of Natural History:

Sirs:—A committee was appointed by the council of the Boston Society of Natural History, at the meeting of Oct. 23, 1875, to make definite propositions to the commissioners with regard to the part, if any, which was to be taken by that Society in the Centennial Exhibition.

In accordance with the suggestions of Mr. Philbrick, the committee have divided their propositions into four heads.

The committee also beg leave to state that they are not empowered to urge the acceptance of these propositions, nor would it be proper for them, in any case, to attempt to magnify the importance of the service rendered to the cause of education by the Society.

They feel that the commissioners themselves are fully informed upon all these points, and are the best judges of the amount of the appropriations which the State can afford to make for such purposes, and therefore most respectfully submit the following propositions without further remark:

First — That the Society furnish a printed account of its past history and present condition and operations. This would include an explanation of the manner of arrangement of the Museum, and its uses in connection with the educational system of Massachusetts, as well as information with regard to the Lowell Lectures on Natural History, and the Teachers' School of Science supported by Mr. John Cummings.

This will cost the Society a certain outlay, but is in the direct line of their customary expenditures, and can therefore be done without cost to the commission. A certain amount of space would be essential in order to show the implements used in the lectures, the character of the specimens distributed as illustrations of the lectures given to teachers, and for the reception of the publications of the Society; say, fourteen square feet of shelving.

Second — That the Society endeavor to furnish plans of their building, of such a size as may be recommended by the commissioners. The committee cannot bind themselves to do this, but have reasonable hopes of obtaining these plans free of cost. The building is claimed to be one of the best, if not the best, of its class yet constructed. Together with these plans, the committee would propose to show such drawings of the cases and furniture as might be deemed desirable. The cases are probably, though made in the plainest manner, unsurpassed in efficiency, and will compare favorably with the elegant structures of the New York, Smithsonian and British Museums.

Third — That the Society furnish a synoptical collection exhibiting the extent and quality of the Museum and its mode of arrangement.

The Museum contains a classified series of collections, showing the forms of all the natural products of the earth in the order of their affinities, beginning with the elements and ending with man.

The natural order of these affinities is strictly preserved.

The visitor is first introduced to minerals in the Mineral Room, then to the association of minerals in the form of rock masses in the Geological Room, then to the characteristic fossil plants and animals of each stratum of rock in the Palæontological Rooms, then to the systematically arranged plants and animals of the present time, which occupy all the rooms of the remainder of the building.

The same natural order is preserved in each room or department, the elementary forms being shown first, and the more complex in one or more series of ascending scales. The construction of the building is such that this can be done without confusing the visitor, who can review either the whole or any part of the collections, and yet receive a similar impression with regard to the interdependence of natural products, and the logical sequence of their affinities.

In other words, the Museum is a copiously illustrated natural history of the earth, of its elements, constituent minerals and architecture — of its history in past geological time, and its present condition so far as that can be presented in the existing minerals, plants and animals. In order to show this plan fully and make an impression, which would not fail to attract the attention of all persons interested in education and science, it would be necessary to allow one or two cases to each department, this being in about the proportion of one-twentieth or one-thirtieth, according to the size of the department.

The whole number of cases necessary would then be fifteen, and when set up would occupy one hundred and sixty-five feet of linear measure. Their other dimensions should be as follows: Depth to wall eighteen inches, height from floor seven feet.

The attractiveness and beauty of such a display would be very great independently of its value as an exponent of advanced views with regard to the proper uses of specimens in public museums, but the cost to the Society would be very considerable, not less than two thousand dollars.

Fourth — That the Society also exhibit selected portions of its New England collection. This follows the preceding collections, the arrangement of which has just been described, and supplements them. It contains all the species of minerals, fossils, plants and animals found within the geographical limits of New England, and it is arranged upon an entirely distinct plan from all the other collections. The specimens are means for the use of those seeking special information with regard to any particular form found in this vicinity, and the Society strives to bring together all the attainable facts with regard to even the minutest variation in structure or habit. Multiplicity in the main body of the collections is avoided, types alone are selected; multiplicity of specimens is here the rule, exhibition of types impossible. The New England collections, in other words, serve as illustrated sources of reference for the correction or confirmation of facts observed in the field work of the teacher or general student, which last work can only be intelligently entered upon after the study of the general connections of things in the type collections. This department could be completely illustrated with selections occupying twelve cases, extending eighty-four feet, and the cost to the Society of the preparation and care of the same would be at least one thousand dollars.

THOMAS T. BOUVÉ, *President Bost. Soc. Nat. Hist.*
JOHN CUMMINGS, *Vice President.*
ALPHEUS HYATT, *Custodian.*

SECRETARY'S REPORT.

LECTURES.

Four courses of free Lectures, supported as usual by the generosity of John A. Lowell, Esq., as Trustee of the Lowell Institute, have been given during the winter, as follows: six by Prof. E. S. Morse, entitled "Six New Engand Animals and their nearest Allies"; six on "Botany," by Prof. G. L. Goodale; six on the "Ancient Rocks of North America," by Prof. T. Sterry Hunt; and two on "Mineral Veins and Ores," by Mr. L. S. Burbank. The botanical course had the largest attendance, averaging 192.

LIBRARY.

The additions during the past year number 1719, which may be classified as follows: —

	8vo.	4to.	folio.	
Volumes	275	52		327
Parts	807	292	9	1108
Pamphlets	193	24		217
Maps and Charts				67
Total				1719

The more important additions include a nearly complete set of Siebold and Köllicker's "Zeitschrift für wissenschaftlichen Zoologie," the completion of the Zoological portion of the "Annales des Sciences Naturelles" (from 1834), and Dresser and Sharpe's "Birds of Europe."

We are indebted especially to the following Societies for large series of their earlier publications.

K. Leopold.-Carol. Deutsche Akademie der Naturforscher	Dresden.
Société d'Hist. Nat. du dépt. de la Moselle.	Metz.
Reale Accad. Lucchese di Scienze, Lettere ed Arti	Lucca.
Feuille des jeunes Naturalistes	Paris.

During the year the following new exchanges have been arranged: —

The Quarterly Journal of Conchology	Leeds.
The Entomologist's Monthly Magazine	London.

Poughkeepsie Society of Natural Science	Poughkeepsie.
Nat. Hist. Society of Kansas State University . . .	Lawrence, Kan.
Société Linnéenne du Nord de la France	Amiens.
Watford Nat. Hist. Society and Hertfordshire Field Club .	Watford.
Verein für naturwissenschaftliche Unterhaltung . .	Hamburg.
Société Géologique de Belgique	Liége.
Verein für Erdkunke	Leipzig.
Società Toscana di Scienze Naturali	Pisa.
Nederlandsche Dierkundige Vereeniging	Rotterdam.
Asiatic Society of Japan	Yokohama.
Società dei Naturalisti	Modena.
Commissão Geologica	Brazil.
The Scientific Monthly	Toledo, O.

The following figures will show the present condition of the Society's Library: — Volumes, 11,944; Pamphlets, 4,145; Maps, Charts, Photographs, etc., 189; total, 16,278.

During the year the numbering of the card catalogue has been completed. Owing to lack of means a few miscellaneous works only have been bound; to place our library in a satisfactory condition in this respect will require a very large expenditure. The plan of devoting the larger portion of the Wolcott Fund to the completion of fragmentary serial publications in our possession has been faithfully carried out, and I hope will be continued.

The number of books borrowed from the Library during the year is 987; they have been used by 130 persons. These figures show a rapidly increasing use of the Library.

PUBLICATIONS.

Our publications for the year embrace two parts each of Vols. XVII and XVIII of the "Proceedings," and three numbers of the "Memoirs," viz.: —

Revision of North American Poriferæ, Part I. By A. Hyatt. pp. 10. One Plate.

Gynandromorphism in Lepidoptera. By A. S. Packard, Jr., M.D. Structure and Transformations of Eumæus Atala. By S. H. Scudder. pp. 11. One Plate.

Monograph of the Tabanidæ, Part II. By C. R. Osten Sacken. pp. 59.

A second volume of the "Occasional Papers" has also been published, which consists of a reprint of the Arachnological writings of Prof. N. M. Hentz, with notes and two new plates by Mr. J. H. Emerton, the whole forming a volume of 171 pages, with 21 plates.

TREASURER'S REPORT.

Report of E. Pickering, Treasurer, on the Financial Affairs of the Society, for the year ending April 30th, 1876.

Receipts.			
Courtis Fund Income			$570.00
Pratt Fund Income			810.00
H. F. Wolcott Fund Income			464.00
Walker Fund Income			2,796.82
Bulfinch Street Estate Fund Income			1,992.00
Entomological Fund Income			15.00
Walker Prize Fund Income			329.00
" Grand Prize Fund Income			50.00
General Fund, Dividends, Rents, etc.			3,886.78
Annual Assessments			1,306.00
Admission Fees			75.00
J. Cummings, Donation			1,266.90
R. C. Greenleaf, "			25.00
C. S. Hale, "			50.00
Lowell Institute Subsidy for Lectures			1,101.90
Total			$14,747.40
Expenditures.			
Cabinet		$1,826.27	
Library		558.99	
Salaries and Wages		5,817.99	
Museum Building		518.78	
Repairs of Museum		826.16	
Gas		112.25	
Fuel		573.10	
Insurance		243.75	
Lectures		2,368.80	
Publications and Printing	1,567.56		
Less Receipts on this account	292.77		
		1,274.79	
General Expenses		1,148.91	$15,269.79
Excess of Expenditures			$522.39

E. Pickering, Treasurer,
Boston Society of Natural History.

Boston, May 1, 1876.

We have examined the Treasurer's account, and find the same correctly cast and properly vouched.

John Cummings, R. C. Greenleaf, } *Auditing Committee.*

The Committee on "Walker Prizes" reported that no essays on the prize question of the year had been offered.

Prof. Shaler called the attention of the meeting to two branches of the Society's work which struck him as particularly entitled to praise. The work of Dr. Brooks, in making the admirable models of molluscs, whose form cannot be preserved in their natural state, compares most favorably with all previous work of the kind, making a distinct advance in this branch of illustration. Another matter of the greatest importance is the practical teaching in Mineralogy and Lithology, referred to in the Custodian's report; this teaching is giving public opportunities which are probably unequalled in any other city, and its effect on the advancement of science cannot fail to be felt.

Dr. T. Sterry Hunt also spoke warmly in praise of the work done by the Teachers' School of Science.

A petition, signed by ten members, asking permission to form a Section of Botany, was read and accepted.

The Society then proceeded to the election of officers for the coming year. Messrs. F. H. Brewer and A. G. Bouvé being appointed to collect and count the ballots, announced that the following gentlemen were elected officers for 1876–1877:—

PRESIDENT,
THOMAS T. BOUVÉ.

VICE-PRESIDENTS,
SAMUEL H. SCUDDER, JOHN CUMMINGS.

CUSTODIAN,
ALPHEUS HYATT.

HONORARY SECRETARY,
S. L. ABBOT, M.D.

SECRETARY,
EDWARD BURGESS.

TREASURER,
EDWARD PICKERING.

LIBRARIAN,
EDWARD BURGESS.

COMMITTEES ON DEPARTMENTS.

Minerals.
THOMAS T. BOUVÉ,
L. S. BURBANK,
R. H. RICHARDS.

Geology.
L. S. BURBANK,
T. STERRY HUNT,
WM. H. NILES.

Palæontology.
THOS. T. BOUVÉ,
N. S. SHALER,
JULES MARCOU.

Botany.
JOHN CUMMINGS,
CHARLES J. SPRAGUE,
J. AMORY LOWELL.

Microscopy.
EDWIN BICKNELL,
R. C. GREENLEAF,
B. JOY JEFFRIES, M.D.

Comparative Anatomy.
THOMAS DWIGHT, JR., M.D.,
J. C. WHITE, M.D.

Radiates, Crustaceans and Worms.
H. A. HAGEN, M.D.,
ALEXANDER AGASSIZ,
L. F. DE POURTALES.

Mollusks.
EDWARD S. MORSE,
J. HENRY BLAKE,
LEVI L. THAXTER.

Insects.
S. H. SCUDDER,
EDWARD BURGESS,
A. S. PACKARD, JR., M.D.

Fishes and Reptiles.
F. W. PUTNAM,
S. KNEELAND, M.D.,
RICHARD BLISS, JR.

Birds.
THOMAS M. BREWER, M.D.,
SAMUEL CABOT, M.D.,
J. A. ALLEN.

Mammals.
J. A. ALLEN,
J. B. S. JACKSON, M.D.

The final consideration of the changes in the Constitution and By-Laws, discussed during the previous meetings, resulted in the adoption of the following amended articles: —

CONSTITUTION.

ART. II. It shall consist of Associate, Corporate, Corresponding and Honorary Members, and Patrons.

ART. III. All members shall be chosen by ballot, after having been nominated at a preceding meeting; the affirmative votes of three-fourths of the Corporate Members present shall be necessary to a choice. The nomination of Corporate, Corresponding and Honorary Members shall proceed from the Council. Any person who shall contribute, at one time, to the funds of the Society, a sum not less than three hundred dollars, shall be a Patron.

ART. IV. Corporate Members only shall be entitled to vote, to hold office, or to transact business; Corresponding and Honorary Members and Patrons may attend the meetings and take part in the scientific discussions of the Society; they may, however, on application, be transferred to the list of Corporate Members by a majority vote of the Council. Associate Members may attend such meetings as are designated by the Council, and take part in the scientific discussions at the same.

ART. V. The officers of the Society shall be a President; two Vice Presidents; a Custodian; an Honorary Secretary; a Secretary; a Treasurer; a Librarian; and a Committee of three on each department of the Museum; who, together, shall form a Board for the management of the concerns of the Society, and be called the Council, of which the Secretary shall be the clerk, *ex officio*.

ARTICLE VI. Officers shall be chosen by ballot, after having been nominated at a preceding meeting, and a majority of votes of the Corporate Members present shall be sufficient for a choice.

ARTICLE VIII. This Constitution may be altered or amended in any of the preceding Articles, by a vote to that effect, of three-fourths of the Corporate Members present at any two consecutive meetings of the Society; the members having been first duly notified of any proposed alteration: but the Article which immediately follows this shall be unalterable.

BY-LAWS.

SECTION I. ART. 1. Elections for membership shall be held at the first meeting in the months of January, March, May and November. Any person of respectable character and attainments, residing in the City of Boston or its immediate neighborhood, shall be eligible as an Associate Member of this Society. Nominations must be made in writing, by three members, at least one month previous to the time of elections; such nominations shall be made to a Committee consisting of the President, Secretary and Treasurer, who shall report upon the same at the meeting previous to that upon which elections are to be held. Every person elected shall, within six months from the date of election, pay into the Treasury an admission fee of five dollars, and subscribe an obligation, promising to conform to the Constitution and By-Laws of the Society; and until these conditions are fulfilled, shall possess none of the rights of membership, nor be enrolled upon the list of members.

ART. 2. Corporate Members may be chosen only from Associate Members of a year's standing, who are either professionally engaged in science, or have aided its advancement. Corresponding and Honorary Members may be selected from persons eminent for their attainments in science, on whom the Society may wish to confer a compliment of respect. Neither Corresponding nor Honorary Members shall be required to pay an admission fee or other contribution.

ART. 5. Members may be expelled from the Society by a vote of three-fourths of the Corporate Members present, at a meeting specially called to consider the question by a notice given at least one month previous.

SECT. III. ART. 3. The Custodian shall be a person of acknowledged scientific attainments. He shall have general charge of the building and its contents; shall have free access to all the collections at all times; and shall act in concert with the Committees, to whom he shall bear the relation of adviser and assistant. In case of the absence or neglect of Committees, he shall act in their stead, and perform their duties. He shall prepare and read at the annual meeting a report of the state of the museum, compiled from the special report made to him by the Committees. He shall acknowledge all donations and keep a book to be called a Donation Book, in which shall be recorded, under their respective departments, all donations to the museum, with the date and name of donor. And he shall perform such other duties as may be prescribed by the Council and mutually assented to.

ART. 4. The Honorary Secretary shall keep the common seal; notify Corresponding and Honorary Members of their election; and receive and read to the Society all communications which may be addressed to him.

ART. 5. The Secretary shall take and preserve correct minutes of the proceedings of the Society and Council, in books to be kept for that purpose; shall have the charge of all records belonging to the Society; shall conduct the correspondence of the Society, and keep a record thereof; shall notify Corporate and Associate Members of their election, and committees of their appointment; shall call special meetings when directed by the President; and shall notify members residing in the vicinity of all meetings, and officers of all matters which shall occur at any meeting requiring their action.

Art. 8. The Committees shall be responsible for the care of the particular departments of the Museum assigned to them at the time of their election; they shall consist of not more than three members, of whom the first named shall act as chairman in each department; they shall, as soon as possible after a donation is made or specimens received, deposit them in their respective cabinets; shall arrange the specimens in their appropriate departments according to some system approved by the Custodian; and, so far as is practicable, label them with the names they bear in such system. They shall also, so far as is practicable, keep a correct list of the articles in their care, and shall be authorized to select duplicate specimens from the cabinet, and, with the assent of the Custodian, effect exchanges therewith. The Committees shall make written reports to the Custodian, a month previous to the annual meeting, concerning the collection under their charge, the additions made during the year, and any important deficiencies which exist.

Sect. iv. Art. 1. Every Corporate and Associate Member shall be subject to an annual assessment of five dollars, payable on the first day of October in each year; but no assessment shall be required of any Associate Member during the six months succeeding his election. Commutation may be purchased for fifty dollars.

Sect. ix. Art. 1. A meeting shall be held on the first Wednesday in May annually, for the choice of officers and other general purposes. At this meeting the Custodian shall present a report upon the condition and progress of the museum, the lectures which he superintends, and any other matters of general interest; the Secretary upon the library, publications, meetings, and the lectures which he superintends; the Treasurer upon the receipts and expenditures of the year; and the Trustees upon the financial condition of the Society.

Art. 4. The order of proceeding at meetings shall be as follows:—

1. Record of preceding meeting read.
2. Candidates for membership proposed.
3. Balloting for members.
4. Scientific communications.
5. Business called up by special resolution, or otherwise.
6. Donations announced.
7. Adjournment.

Sect. x. Art. 1. Sections of the Society, holding separate meetings of their own, may be formed on the written application of ten Corporate Members, by the consent of the Corporate Members present at two consecutive meetings of the general Society. As in the general Society, Corporate Members alone shall be entitled to vote, to hold office, or to transact business.

ART. 2. The requirements of membership shall be:—

1. Membership in the general Society.
2. Written nomination by two members at a regular meeting of the Section.
3. Election by a three fourths vote of the Corporate Members present at the subsequent meeting.
4. Signature to the standing rules within six months from the date of election.

ART. 4. Such notice of each meeting as shall be judged by the publishing committee suitable for publication in the Proceedings or Memoirs of the Society, may be announced by the Secretary at the next regular meeting of the Society.

SECT. XI. ART. 1. The By-Laws of the Society may be altered or amended by a majority vote of the Corporate Members present at any meeting; provided that they shall have been duly notified, two weeks previous, of an intended change.

It was further voted: that the above amendments go into effect after the next quarterly meeting (July 5, 1876).

Section of Botany. May 4, 1876.

Sixteen persons (including six ladies) present.

The Secretary called the meeting to order, explaining that the Society had given its consent to the formation of a Botanical Section, and that he had, therefore, called the present meeting of those interested in Botany to take action for the organization of the Section.

Mr. T. P. James was elected chairman.

Drs. G. L. Goodale and J. C. White, and Mr. E. Burgess, made some remarks concerning the regulations of the new Section, and it was voted, on motion of Dr. White, that a committee of three be appointed to prepare a plan of organization and work. Messrs. Goodale, Farlow and Dimmock were accordingly appointed.

The meeting then adjourned to the following Wednesday.

Section of Botany. May 10, 1876.

Dr. J. C. White in the chair. Thirty-four persons present.

The Committee appointed at the last meeting to present a plan of organization for the Section reported, through Dr. Goodale, the following recommendations: —

That the meetings be conducted as informally as possible, the order of business being:

1. Communications, including the exhibition of specimens.
2. Informal discussion of the topics thus brought up.
3. Reports on the latest botanical researches.

The Committee further recommend that the members should join in the preparation of a complete catalogue of the plants of the vicinity.

The report was accepted and adopted.

Dr. G. L. Goodale exhibited some drawings prepared by Mr. W. P. Wilson, of an interesting monstrosity observed in some apple blossoms from New Jersey. In these flowers the stamens had been replaced by pistils, and a singular two-storied ovary was formed; the flowers then being wholly female, could only be fertilized from blossoms on adjoining trees. Dr. Goodale had not been informed whether the fruit showed any peculiarities.

Dr. W. G. Farlow described the nature of the so-called "cedar-apple," which is produced by a fungus.

Mr. R. W. Greenleaf exhibited some flowers of *Posoqueria longiflora*, a Brazilian plant, and, by a set of drawings, showed the peculiar contrivances to insure cross-fertilization.

The anthers cohere by the interlacing of their marginal fibres, thus forming a sac which contains the pollen.

One of the five stamens has a stout filament, which is in a state of tension, and which, when the anther sac is touched, flies forward and over the mouth of the corolla tube; the pollen at the same time being hurled from the flower. After some hours this filament relaxes and bends back, thus opening the orifice of the corolla tube.

The style is but one half the length of the slender corolla tube, hence it is impossible for pollen from one flower to reach the stigma of the same flower.

Mr. Charles Wright, who had studied the plant in the vicinity of Rio Janeiro, said that Fritz Müller had ascribed the task of fertilizing Posoqueria to small insects. Mr. Wright could not agree with this conclusion, and believed the duty was performed by some long-tongued hawk-moth. He observed that a few flowers were fertilized in the greenhouse at Cambridge, but probably by some accident.

Mr. Sereno Watson suggested the possible explanation that pollen reached the stigmas of flowers from which the corollas had fallen.

It was voted to meet for the present every Monday afternoon at 4 o'clock.

Section of Botany. May 15, 1876.

Dr. J. C. White in the chair. Forty-one persons present.

Mr. Charles Wright made some remarks on the position of the stamens in the Golden Saxifrage (Chrysosplenium) which has been differently described by different authors. Careful study had shown him unmistakably that the stamens are inserted on the calyx and not on the disk.

Mr. W. P. Wilson exhibited a number of drawings of May-Flowers from Old Orchard, Me., showing the differences in development and relative lengths of stamens and pistils. Some flowers wanted the former entirely, and in these the stigmas always developed five prominent rays.

Dr. Asa Gray read a paper on the same subject, showing that these flowers may be arranged in two groups, one with small stigmas and good stamens, and one with large five-rayed stigmas and poor or no stamens. These groups may be subdivided into two sub-groups each, according as the styles are long or short; the long-styled flowers, however, predominate in each group. Epigæa thus shows a tendency to become diœcious.

Dr. W. G. Farlow said that he had just found the two species of Podisoma, whose occurrence on the White Cedar he had predicted at the last meeting. Specimens of both species were exhibited. Dr. Farlow also exhibited a species of Morel (Morchella) and recommended its edible qualities.

May 17, 1876.

The President, Mr. T. T. Bouvé, in the chair. Forty-two persons present.

Mr. G. W. Bond made some remarks on the result of his studies made during the preparation of a series of the wools of commerce for the Centennial Exhibition.

In the first place he had found indubitable confirmation of the current opinion that the sheep of Spanish America, both North and South (with possibly some other admixture in Chili), originated from the churro, or coarse sheep of Spain, and not from the Merino, as some writers have supposed. The most interesting observation, however, was the discovery of a similarity of the wool of the Mauchamp race of France and that of the Arabian stump-tailed, fat-rumped race or Mecca sheep. Darwin, in the third chapter of his work on the Domestication of Animals and Plants, speaking of sheep, says:—"In some few instances new breeds have suddenly originated; thus in 1791 a ram-lamb was born in Massachusetts having crooked legs and a long back like a turnspit dog. From this one lamb the Otter or Ancon breed was raised; as these sheep could not leap over the fences it was thought that they would be valuable, but they have been supplanted by Merinos and thus exterminated."

Huxley, in his lectures on the Origin of Species, also speaks of this race, and expressed a regret that no skeleton had been preserved. Mr. Bond had the good fortune, through the kindness of Mr. R. G. Hazard, of Rhode Island, to find a small flock of eight still living there, and obtained two, one, at the request of Prof. H. P. Bowditch, for the Society. This deformed race has, therefore, been perpetuated through many generations during eighty-five years.

Darwin also remarks, continued Mr. Bond: — "A more interesting case has been recorded in the report of the Juries of the Great Exposition (1857), namely, the introduction of a Merino ram-lamb on the Mauchamp farm in 1828, which was remarkable for its long, smooth, straight and silky wool. By the year 1833 Mr. Graux had raised rams enough to serve his whole flock; and after a few more years he was able to sell stock of his new breed. So peculiar and valuable is the wool that it sells at twenty-five per cent. above the best Merino wool; even the fleeces of half-bred animals are valuable, and are known in France as the Mauchamp Merino."

This ram was born with hair, and when it dropped its first hair the fine, straight, silky wool appeared. Mr. Bond having heard of other lambs being born in pure Merino flocks with hair, long since believed that some common cause must be found, and that the Mauchamp was not, like the Otter, a freak of nature, but more likely a reversion which might help to discover the origin of the Merino race, a point which has never been settled. A short time ago a specimen of wool, which the speaker showed, was sent to him from New York to ascertain what it was. It was much longer, but in other respects like the wool of the Mecca sheep. Mr. Bond concluded it was what should be found on that race raised under circumstances favorable to the full development of its covering.

Dr. L. Fitzinger, in an interesting paper on the Domestic sheep, published in the Sitzungsberichte of the Imperial Academy of Vienna, for 1859–60, says of the Stump-tailed sheep: "It is about the size of the smaller races of Merino sheep, and reminds one in its general form, with the exception of its peculiar shaped tail, of our common domestic sheep."

Of the Mecca, or fat-rumped, stump-tailed sheep, he says:—"The whole body is thickly covered with short, smooth, close-lying, straight and stiff shining hairs, which are shorter on the face, ears and legs, and beneath these there is found a short, peculiarly fine wavy and elastic wool, which is finer than that of most known races of sheep." The speaker had obtained a skin of this last named race, and found that the covering exactly agrees with this description. A micro-photograph of the wool, magnified about two hundred times, shows that the fibre measures only about $\frac{1}{2000}$ of an inch in diameter, which is as fine as the finest Silesian wool.

On comparing the wool received from New York, before referred to, and separating the hair from the true wool, Mr. Bond found an exact correspondence with the last named wool, and also with that of the Mauchamp sheep. He suggested, therefore, that the Mauchamp sheep might be simply a case of atavism, or reversion to an ancient type. One of the legends respecting the origin of the Merino sheep was that the Arabs, when they went to Spain, found only black and colored sheep, and as they wanted white wool they imported white rams from the East to cross with them. Other accounts say that from time to time rams were imported from Morocco, which amounts to the same thing, as the sheep of Morocco were undoubtedly brought from Arabia. There is, however, more resemblance in the wool of the coarse sheep of Spain (churro) to those with which we are now familiar from Morocco, than in that of the Merino.

The Merino sheep is undoubtedly an animal that either from mode of culture, or some accidental cause, has lost the hairy part of its covering, and the wool has been furnished with a liberal supply of "yolk" or grease to meet the exigencies resulting from this change. If descended from the Arabian sheep, may not the fat deposit of the tail have been diverted to produce the greater amount of "yolk" required to make this wool covering adequate for the protection of the sheep from the external influences to which it was subjected?

Mr. S. H. Scudder called the attention of the Society to the close affiliation of the insects of Europe and America in the Carboniferous epoch.

Although but thirty or forty species were known on either side of the Atlantic, they were in many cases referable to identical genera, and every discovery of new forms seemed to make the resemblance more striking. Doubtless a critical study of the species independently described would reveal even a closer relationship than was now known to exist; for instance, the *Acridites formosus* Gold., of Saarbrück, is unquestionably a Megathentomum, closely allied to *Meg. pustulatum* Scudd., from Illinois. In conclusion, Mr. Scudder expressed his belief that we are already warranted in saying that the insect faunas of Europe and America were as intimately related in Carboniferous times as now.

Section of Botany. June 5, 1876.

Mr. T. T. Bouvé in the chair. Thirty-five persons present.

In relation to the question of the fertilization of the dandelion, which was brought up at the previous meeting, Mr. B. D. Halsted said that he had found the flowers to be visited by bees, and he explained the provision for cross-fertilization.

Mr. W. P. Wilson made more extended remarks on the same subject, showing by drawings that the pollen ripens in each flower before the stigma matures, thus effectually preventing close fertilization. He had found that several species of wild bees, and also the honey-bees, visit the flowers frequently.

Mr. Halsted showed a number of cluster-cups and other parasitic fungi; also the sexual plants of *Osmunda regalis*, whose prothalli are not hermaphroditic, but unisexual.

Mr. R. W. Greenleaf showed a monstrous stalk of asparagus, produced by the union of two stems, and made some remarks on this kind of monstrosity.

Dr. G. L. Goodale called attention to the hitherto unsuspected parasitic or sapraphytic character of some of our common plants, and suggested that the members of the Section pay special attention to the detection of the habit in other plants, especially those which turn black in drying.

In relation to the preparation of a catalogue of local plants, Dr. J. C. White suggested the desirability of preparing exhaustive lists of the plants of the richer localities, before these shall become picked out or otherwise changed.

June 7, 1876.

The President, Mr. T. T. Bouvé, in the chair. Eighteen persons present.

Dr. W. K. Brooks gave a general sketch of the anatomy of the Tunicata, and showed how Salpa, with its separated sexes and other peculiarities, might be produced on the theory of Natural Selection. Dr. Brooks called especial attention to the locomotive powers of Botryllus, a hitherto unknown fact.

A paper on the Geology of Eastern Massachusetts, by Mr. W. O. Crosby, was presented by title.

The following paper was read: —

Genetic Relations of Stephanoceras. By A. Hyatt.

The group which forms the subject of the present paper was first described by Waagen as part of his genus Stephanoceras, it being with *Dactylioceras commune* and its allies, united as the "sub-group *a*" under this name.[1] *Cœloceras Pettos* was left by the same author under the title of Ægoceras, though the similarities of the latter to *Steph. Humphriesianum* were fully recognized by Waagen in his subsequent paper.[2] In this paper, also, he restricted the use of the name Stephanoceras; and two groups, which had appeared as subgenera of Stephanoceras in his first paper, were elevated to the rank of full genera, under the names of Kosmoceras and Perisphinctes.

The preservation of zoological nomenclature in an available form demands above all things that names shall not be uselessly multiplied,

[1] Die Formenreihe d. Amm. subradiatus. Benecke's Geog. Pal. Beiträge, Vol. 2, p. 248.

[2] Ueb. d. Ansatzstelle d. Haftsmuskeln b. Naut. und Amm., Paleontographica, Vol. 17, 5, p. 215.

and for that reason the law of priority has been universally recognized and mercilessly applied. Waagen, and all other German Paleontologists who have quoted his names, have disregarded this law in a wholesale manner. The only reason for this conduct, and the most charitable one which can be given, is, that they considered the new names proposed by Prof. Agassiz and myself as untenable, and unworthy of their adoption. This reason, although perhaps sufficient to themselves and their followers, is no justification for a violation of the rights of priority. The laws of nomenclature do not permit them to describe the same family groups as new genera with new names. New views of the relations of well known species cannot be represented by new generic names because the grouping happens to include a half dozen or more of the previously described genera. What a fearful maze of difficulties this process would lead to if generally adopted! Every man, or set of men, would of course have the same privilege. For example, let us suppose that in my own recent paper on the "Genetic Relations of the Angulatidæ," in the Proceed. of the Bost. Soc. Nat. History, Vol. XVII, May, 1874, I had originated a new name for the genus Ægoceras of Waagen, because his generic characteristics are of no value for the distinction of groups of generic significance. The genus Ægoceras, according to Waagen, contains forms as widely separated as *Psiloceras planorbis*, belonging to the Arietidæ, *Ægoceras angulatus*, one of the Angulatidæ, *Androgynoceras Henleyi*, one of the Liparoceratidæ, and *Cœloceras Pettos* of the Dactyloidæ. According to their development, mode of occurrence in time, and all their adult characteristics, except perhaps "the undivided, horny character of the Aptychus," these forms are perfectly distinct from each other.

The Psiloceras becomes the parent form of the Arietidæ in the Lias, the *Ægoceras angulatum* of another distinct series differing wholly in development and form in the same formation. Both of these are probably traceable to a common ancestor in the Trias, according to Waagen and Mojsisovics,[1] and therefore it may perhaps be considered that it is legitimate to join them, but what can be said with regard to the remaining forms? *Androgynoceras Henleyi* is directly traceable to *Deroceras Dudressieri*, the affinities of which cannot be settled with our present knowledge conclusively; but what evidence there is, however, in the development of the young shows

[1] See also my paper on the "Genetic Relations of the Angulatidæ," in these Proceedings, Vol. XVII, p. 15.

most decidedly, as might be anticipated from the adult characteristics, that the ancestral forms are to be sought in the Lytoceras and allied groups, not in Psiloceran forms of the Trias. *Cœloceras Pettos* is equally of uncertain derivation, though its affinities in every respect show also that it belongs to the Dudressieri series.

All of these forms are included under the name Stephanoceras, and thus two great groups of Ammonites, the round abdomened and the keeled groups, with distinct systems of development and uncertain derivation are made to appear as one genetically connected series. This, however, would not justify the total suppression of the name Ægoceras and the substitution of another for the more limited group, to which it can be properly applied. Scientific courtesy, as well as the strict law of custom, forbids such a course, though here, as in the Arietidæ, I must consider the name as used by Waagen utterly devoid of zoological meaning. The structure of the Aptychus has, no doubt, some meaning, but it alone certainly cannot unite *Psil. planorbis*, *Ægoc. angulatus*, *Cœloceras Pettos*, *Microderoceras Birchii*, etc., into one genus, because as Waagen himself points out, it has the same structure in two other groups, Arietites and Amaltheus, described by him as distinct genera If he had joined all these into one group and distinguished them by the Aptychus, it would have been more consistent and less objectionable; this characteristic would have at any rate applied to them all.

I allude particularly to this fact because the other characteristics given by Waagen are not applicable to such large groups. Thus in the lower forms of the Arietidæ (that is to say, my genera Psiloceras, Caloceras and Vermiceras, including the *planorbis*, *raricostatus* and *Conybeari* series), the length of the living chamber, one of Waagen's distinctive characteristics, is generally over one volution. In the genus Arnioceras, the *falcaries* series, its length is generally less than one volution, from one half to nearly a full volution. In Coroniceras, from one-half to one. In *Asteroceras obtusum* the length is from one-half to five-eighths of a volution in large specimens, in *Asteroceras Brookii* about three-fourths. In *Agassiceras lævigatus*, five-eighths to three-fourths of a volution, in *Agassiceras Scipionianus*, about three-fourths. Thus in all the higher genera of the same family it is less than one volution, and so variable that it cannot be very usefully employed, even as a specific characteristic in some species, such *Aster. obtusum.*

The outline of the mouth has been long used to designate subgroups among the Ammonites. This characteristic, like all others, is of different values in different groups, and the attempt to use it with the same meaning in every group results, as in all other cases, in confusion. Thus in Waagen's diagnoses of the genera Stephanoceras, Perisphinctes and Kosmoceras, we find that they are all three described as having "simple (entire) mouth-openings or ears." In each genus the characteristics of the Aptychus are the same, as stated by Waagen, and each has the same variability in the outlines of the mouth. These surely will not suffice to distinguish them, since they are precisely the same in each genus, and we have to fall back on the length of the living chamber or the comparative length of the animal and shell.

I do not mean to be understood as denying the existence of natural sub-groups of generic value, for undoubtedly such do exist, and some of them must bear Waagen's names in nomenclature, but merely to point out the inapplicability of such characteristics as he has arbitrarily employed to distinguish them. In many other groups the outlines of the mouth are exceedingly constant, as in the Arietidæ, and are very properly used to designate them in common with other characteristics.

I allude principally to these three characteristics, the Aptychus, the length of the living chamber and the mouth outline, because it is only in the application of these that Waagen differs from other naturalists, especially in the former, since Suess applied the two latter to the distinction of his genera Lytoceras and Phylloceras.

Such differences in the views of Paleontologists as are above alluded to, lie deeper, however, than any such contrasts in the translation and application of facts. They rest upon the different modes of study, which distinguish two schools of Naturalists. In one school the effort is being perpetually made to discover some set of characteristics by which animals may be distinguished one from another. Every new organ, or indication of such, when discovered, is applied at once to the definition of groups, as if this was the great object of all classification. The distinction of groups from each other doubtless represents to a certain extent our knowledge of their organization, but only in proportion to the number of the parts or characteristics which may be employed in classification. Consequently arbitrary classifications based on single characteristics are the most imperfect, since they necessarily leave out of consideration the numberless affinities of the groups, and all the minor points of difference which here and there appear.

In the other school, a zoologist or paleontologist makes greater allowance for the variability of organic bodies, becomes distrustful of all single characteristics, or combination of single characteristics, and endeavors to combine all possible sources of information in his definition of groups.

The former naturally tends to the formation of large generic groups, those which can be approximately distinguished by some salient structural characteristic, and the latter to the division of these large groups into many minor ones, in order to show the natural affinities and derivation of animal forms.

The former leads to the artificial method of classification which has always, without the slightest reason, been claimed to be the more useful, and the latter to the approximately natural method. The differences are most prominently presented in one, and in the other these are considered of no more importance than any other class of characteristics. The first is certainly the most imperfect and conventional; and why its defects, which are openly confessed, should be regarded as recommendations for its adoption, or how it becomes by means of its confused imperfection more convenient, is equally incomprehensible. Is it more convenient to consider under the same head the genus Antipathes, one of the Alcyonoid corals and the Aplysinæ among the Keratose Sponges, because their skeleton is identical structually? This would be considered absurd; but undoubtedly, if found fossil no purely Paleontological student could show an essential difference between them, and according to the demands of convenience, as understood by most of them, this absurdity ought to be committed. Innumerable instances might be quoted of a similar description, but it is unnecessary; practically the natural system of classification is always adopted after a certain lapse of time, and the different artificial and single character systems become obsolete.

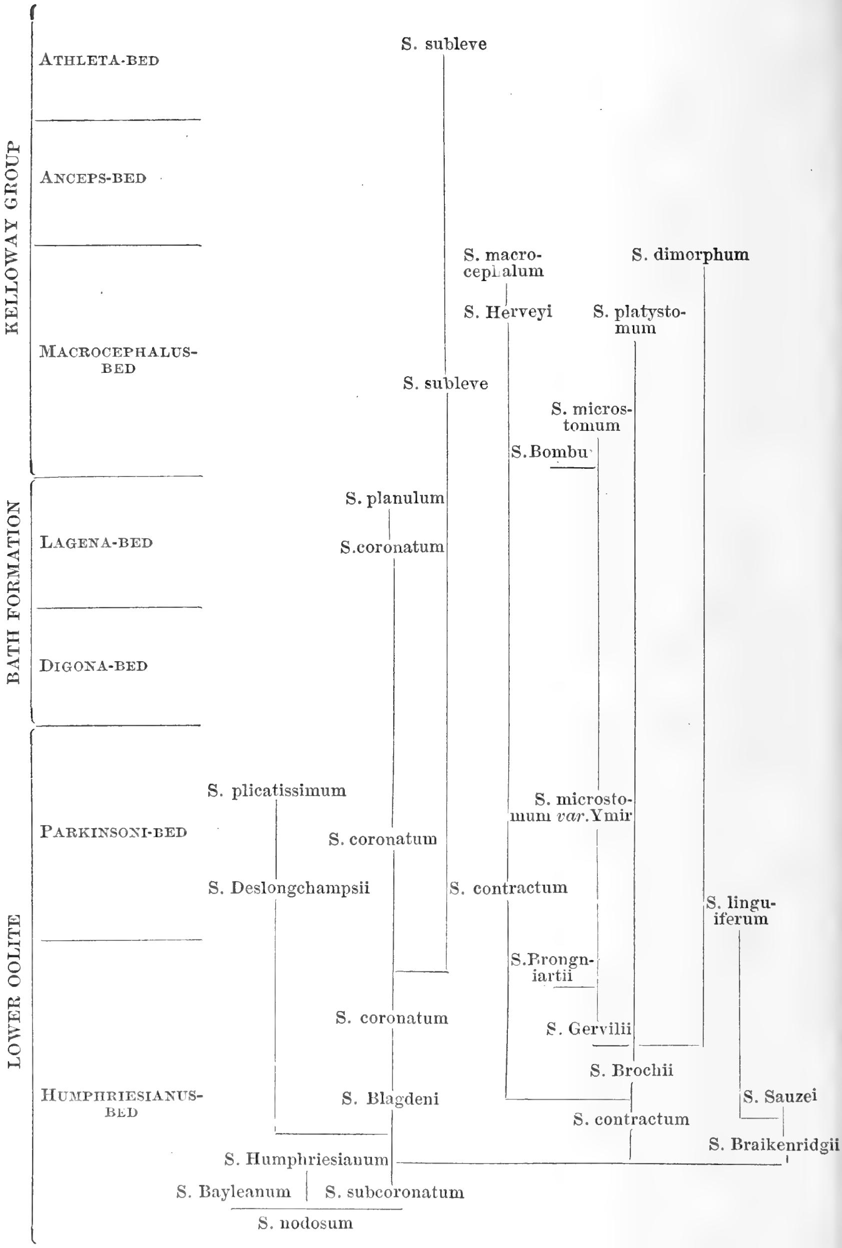
I do not mean to underrate the great service done to the Natural History of the Ammonoid and Nautiloid Groups by Dr. Waagen. Waagen's treatise on the Annular Muscle of the Nautilus and Ammonites, the characteristic position and probable homology of the Aptychus with the similarly situated coverings of the heart in *Nautilus Pompilius* and observations on the length of the living chamber, are solid and permanent contributions, which cannot be too highly appreciated; but the mode of application of these to the classification of the Ammonoids is, according to my views, entirely

Insert between the words "the" and "heart," page 364, fifth line from the bottom, these words — "nidamental glands above the"

faulty, and calculated only to mislead any naturalist who is desirous of understanding the affinities of these fossils.

There is nothing to be dreaded in new names, except by those who strive to get the animal kingdom by heart, as if the principal business of life was not to understand things, but to be able to indulge in an unending string of parrot talk. New names, like new things of all kinds, are not necessarily bad, they become so only when they violate certain essential restrictions, or are used to represent affinities which have no real existence. Used in a proper manner they are clearly a great advantage, since they force the unwilling or indifferent to pay some attention to the new views announced, and to represent or criticise them more or less in their collections and writings, and in this way they really become one of the most essential instruments in forwarding the general progress of knowledge.

For example, if Quenstedt had given a new generic name to every natural series of the Ammonites, which he has so admirably followed out in his grand work on the Jura, there would have been no occasion for the criticisms made above. Paleontologists would as long ago as the publication of Die Cephalopoden, in 1846, have begun to consider them in their natural relations, and now it would have been an act of scientific heresy to think of the Ammonites as anything but a large and important group divisible into many families and genera. Quenstedt's researches failed in this one technical point of apparently no essential value, and one which even now he would probably treat with the contempt born of the habit of contemplating more important things. I consider this, however, to have been a very unfortunate mistake, since it is owing to this, and this alone, that Aug. Quenstedt's work has not been universally known as the only one in Paleontology which at that early period adopted the only true system of classification, and fearlessly recognized the variability of forms and their passage into each other. He studied them in their development, adult characteristics, and even their diseases, and although all his observations were directed towards the definition of strata, struck the key note of true zoological classification in his work on the Jura, p. 20, where he writes, "aber der Fortschritt der Wissenschaft besteht nicht blos im Trennen, sondern auch im richtigen Verbinden, und letzteres —— ist entschieden das Schwierigere." His collection and his published works exhibit a knowledge of this group and their true relations which has never been equalled, and which must form the basis of all future classifications, and as


KELLOWAY GROUP
ATHLETA-BED
ANCEPS-BED
MACROCEPHALUS-BED
BATH FORMATION
LAGENA-BED
DIGONA-BED
LOWER OOLITE
PARKINSONI-BED
HUMPHRIESIANUS-BED
S. subleve
S. macro-cephalum
S. dimorphum
S. Herveyi
S. platysto-mum
S. subleve
S. micros-tomum
S. Bombur
S. planulum
S. coronatum
S. plicatissimum
S. microsto-mum var. Ymir
S. coronatum
S. Deslongchampsii
S. contractum
S. lingu-iferum
S. Brongn-iartii
S. coronatum
S. Gervilii
S. Brochii
S. Blagdeni
S. Sauzei
S. contractum
S. Braikenridgii
S. Humphriesianum
S. Bayleanum
S. subcoronatum
S. nodosum

early as 1846 he adopted the mode of work which is fast becoming universal, that of uniting in the same genetic series all forms, however dissimilar in aspect, which can be traced into each other, by means of the young and of the adult characteristics.

STEPHANOCERAS[1] Waagen (Pars).

The earliest observed form of this genus is the *Steph. nodosum* = *Humphriesianus nodosus* Quenst., which occurs in the Humphriesianus-bed. This variety or species, whichever the taste of the reader prefers, has the ribs more prominent and more widely separated than in *Humphriesianum*, the umbilicus larger, and the whorls increasing more slowly in size by growth; this renders the shell altogether more discoidal in aspect. The varieties, however, show a shading of the characteristics in three different directions. One way leads to *Steph. Bayleanum*, and another to *Steph. Humphriesianum*, and still another to *subcoronatum*. Towards *Bayleanum* a retrograde series of changes produces forms more and more discoidal, with whorls increasing more and more slowly in size by growth, until in the typical *Bayleanum* a very distinct species appears, as figured by D'Orbigny, and discussed by Oppel. It occurs contemporaneously with *nodosum*, and also later in the upper part of the Humphriesianus-bed.

In a similar way, by following the indications of the gradually changing varieties we are led to the stoutest, most involute and narrow-umbilicated forms of the typical *Steph. Humphriesianum*. In these the abdomen is also more elevated and rounder, the ribs are finer and more numerous, and the sutures distinct. *Steph. subcoronatum*, as pointed out by Oppel and Quenstedt, is one of the transition forms of *Humphriesianum*, but it has a wider significance when carefully studied in all its varieties. It becomes identical with *Amm. Deslongchampsii* when the ribs are curved and prominently tuberculated, and the abdomen somewhat elevated, though still very broad. The abdomen becomes in some specimens still more elevated, the umbilicus narrower than in the *Deslongchampsii*, the umbilical shoulder of the whorl more abrupt, the umbilicus deeper, the abdominal ribs par-

[1] This name, as has been pointed out to me by E. B. Tawney, Esq., of Bristol, has been already occupied by Ehrenberg for a genus of Rotatoria, but the termination adopted was spelled with an "o" instead of an "a," Stephanoceros instead of Stephanoceras, and this seems to me quite sufficient under the circumstances to justify its retention.

ticularly fine and numerous, the lateral ribs like those of *Steph. linguiferum* or those of *Steph. Deslongchampsii.* These are apparently identical with the *plicatissimum* of Quenstedt. Both of these forms, *Steph. plicatissimum* and *Steph. Deslongchampsii*, are found in the Parkinsoni-bed.

Some of the varieties of *Steph. subcoronatum* are nearly identical with *Steph. nodosum*, and some of them resemble closely the smaller specimens of *Steph. coronatum* or *Blagdeni.* The forms from Dundry, and also those alluded to in Quenstedt's descriptions of *Humphriesianus*, as allied to *Amm. Brocchii* Sow., show a close series of transitions from the finer ribbed specimens with open umbilici and young like *sub-coronatum* to those with stouter whorls, no tubercles and forms and ribs like true *Brocchii.* The more open umbilicated forms, those like true *nodosum* in aspect, lead by a similar series of gradations apparently into *Braikenridgii*, though here, of course, some doubt must always intervene until the appearance of the ear-like expansions in the latter is fully understood. The connection with *Steph. Herveyi* and *Steph. macrocephalum* can also be traced quite satisfactorily through the series described by Quenstedt, and also studied by myself.

Thus *Steph. subcoronatum* appears theoretically as the typical form of the group, a result which was entirely unexpected, since, until this summary was written, I had always pictured *Humphriesianum* proper as the centre of affinities. Some of the specimens are inseparable from *Humphriesianum* proper until the young are consulted. These invariably show the typical *Steph. subcoronatum* or *nodosum* form and characteristics very distinctly, and are also of a smaller size than the corresponding *Humphriesianum* varieties. The peculiar broad abdomen which characterizes the adults of *nodosum* and the young of *subcoronatum* and *Humphriesianum*, I shall have frequent occasion to speak of, and as its resemblance is general rather than special, I shall speak of it usually as the Pettos-like form, in allusion to its ancestral derivation.

S. Blagdeni may be briefly described as a huge form of a young *sub-coronatum* of the broad abdomened variety in some of its forms; in others, however, the abdomen becomes elevated, and no line can be drawn between these and the succeeding, or true *Steph. coronatum* series. The peculiar broad abdomened forms which began to appear in varieties of *Steph. subcoronatum* are in *Blagdeni*, the predominate ones, and represent the species. The young changes but slightly by growth, except in size, and the Pettos-like form is retained throughout life, except in those varieties which approximate to *coronatum*, or more strictly speaking, except in the round abdomened varieties which approximate to the predominant round abdomened forms of *Steph. coronatum.* These last do not alter the peculiar coarse character of the lateral ribs and tubercles of *Blagdeni*, but simply elevate the abdomen and increase in size faster by growth than the normal varieties, so that the umbilici become narrower, and the sides of the whorls more abrupt. These are often called *Amm. Banksii* Sow., but may be distinguished by the young which have the flat abdomen of the true *Blagdeni* until a late period of growth, while the true *Banksii* has young with a more elevated abdomen and larger tubercles. The Pettos-like form of *Blagdeni* and its peculiar ribs are more or less represented in all the young forms of the true *Steph. coronatum.* Sometimes specimens retain this even to an exaggerated degree, growing up to the adult condition with the sides so sharp, umbilici so deep, and abdomens so flat, that they appear as new specific forms, until the connection is traced between them and the normal forms. These are, as in the case of the similar representative forms found in *Steph. subcoronatum*, generally rather small; such is the variety known as the *anceps-ornati* of Quenstedt, and other scattered varieties intermediate between this and the true broad abdomened *coronatum* forms. Both *Steph. subcoronatum* and *Blagdeni* occur associated in the Humphriesianus-bed, and *Steph. coronatum* later in the Parkinsoni-bed, with the exception, perhaps, of the *Banksii* variety, which may possibly occur in the Humphriesianus-bed.

The tendency of some varieties of the preceding species to narrow the abdomen and depress the sides, is more strongly expressed in *Steph. coronatum* than in any other species of this group, it having become characteristic of all the adults of the normal form and of the young, though in many individuals not perceptible until a late stage of growth. This stronger expression of an evidently inherited tendency is accompanied by a correllative tendency to the suppression or absorption of the tubercles and ribs. These changes are retrograde in so far as they produce a form smaller and less ornate than the preceding, and because they may be directly compared with some of the retrograde changes first observed in the old age of ancestral species. The tendency of the old of *Humphriesianum* is to decrease the size of the whorl in every way, and according to D'Orbigny, very old specimens become smooth, losing tubercles and ribs.

In *Steph. subcoronatum* the contraction is also well marked as old age advances, though here, as in *Humphriesianum*, the time at which old age may begin varies greatly. In *Blagdeni* I was not able to observe any very marked old age changes, except perhaps a tendency to narrow the abdomen.

In the *Banksii* variety of *Steph. coronatum* the old age changes are well marked, the tubercles decreasing in size, and the ribs becoming depressed and finally obsolete. In the *planulum* variety of *coronatum* this retrograde tendency is carried out fully, appearing even in the adult shell, so that the abdomen becomes very narrow, and the ribs in some specimens have no tubercles, except in the earlier stages of growth. The extreme changes in the individual figured by D'Orbigny, I have not observed, but his figures are doubtless correct, since the indications of the obsolescence of the ribs, and the depression of the angular sides in the normal variety, are very marked in much smaller shells than those which he describes as having only undulations on the side at the diameter of 230 mm., and that which he figures as entirely smooth at the diameter of 486 mm. None of these are found in his collection, but probably exist elsewhere, although he does not allude to them in this connection. Even at this enormous size, 486 mm., the shell of the normal variety, *i.e.*, that which has the Blagdeni- or Pettos-like form until a late stage of growth (see D'Orbigny, Terr. Jurass., pl. 169, fig. 1–2, and pl. 168), retains the lateral tubercles, though these are so close to the umbilical edge as to give them an entirely distinct aspect.

It will be observed that these old age metamorphisms of the individual are not only correllative with those occurring in the *planulum* varieties of *Steph. coronatum*, but they also resemble, in a measure, the changes which take place in the evolution of the *Steph. Bayleanum* out of the *Steph. nodosum* forms. This consists simply of a decrease in size of the whorls. When it takes place in an old specimen of *Steph. nodosum* it is an old age degradational change. When it takes place at an earlier stage it produces forms intermediate between *nodosum* and *Bayleanum*; and when at last it occurs at an early age, it changes the quick increase in the growth of the whorls to a slower rate, and produces the narrow whorls and discoidal form of *Bayleanum*. It differs from the old age changes in not going to the extreme extent of destroying the tubercles, ribs, etc.

Quenstedt describes specimens, all of which must, I think, be referred to *Brochii*, in which the tubercles are lost at an early age, but the growth, on the other hand, is not affected, the increase in size being even greater proportionally than in the normal *Humphriesianum* forms leading into the *macrocephalum* group. Upon the whole, the old age or degradational changes which precede death in the individual, are found to be correllative with the products of degradational changes in every direction, whether they result in producing a discoidal form, like *Bayleanum*, a flattened form, like *Steph. planulum*, or a smooth form, like the last described variety of *contractum.*[1] Above the Bath formation the history of this series is fragmentary; the few specimens I have seen present, for the most part, the broad abdomened *coronatum* form. The forms sometimes referred to this series from the White Jura I do not think can be properly designated as descendants. Quenstedt analyses this question very fully in his diagnosis of the convolutus group, p. 578 of Der Jura, and it is also my impression, derived from careful examination of closely allied forms, that even such apparently *coronatum*-like forms as the *Gravesianum*, figured by D'Orbigny, pl. 219 of Terr. Jurassique, will be found to belong to the *convolutum* or *planulatum* group, and that the true *coronati* have no representatives in the White Jura.

The extraordinary form, *Steph. sublæve*, to which we now come, presents in its adult condition so close a resemblance to the *Amm. Goliathus* that Quenstedt is evidently in "Der Jura" doubtful of its true affinities, though he had previously, in "Die Cephaloden," referred it to the *coronatum* group. The development, however, shows none of the peculiar variations observable in the *Amm. Goliathus* group, and the young in some specimens retain the *coronatum* form and characteristics until a late stage of growth. During old age the whorl contracts as it does in *Humphriesianum*. The form and characteristics of the young appear to indicate a derivation from some *coronatum* form, like that found in the Parkinsoni-bed, Museum of Stuttgart Collection. Another characteristic which seems to separate it from the *Goliathus* series is the general tendency of most of the forms to become smooth on the abdomen, at a stage when *Goliathus* is furnished with prominent ribs. Notwithstanding these facts, however, whenever the adult forms come under observation, a similarity becomes apparent which it is at present impossible to explain.

The series which can be followed from *Steph. contractum* to *Brocchii*, and its allied forms, is perhaps the most complete of all others, the

[1] With this compare the old *coronatum* described by D'Orbigny, referred to above.

lines drawn between the different species being so slight that they vary with every locality. *Contractum* can only be separated from *subcoronatum* by the fineness of the ribs on the abdomen, and in the adult by the aspect of the sides. The connection with *subcoronatum* is largely made through the young, which are indistinguishable from the young of that species in some specimens.

The Herveyi-like, or macrocephalum-like forms of *contractum* occurring in the Parkinsoni-bed, have finer ribs than *Herveyi*, but it is probable that they vary greatly in this respect. The young of *Steph. Herveyi* are in some varieties tuberculated, but acquire the aspect and characteristics of the adult of *Steph. contractum*, including the fine abdominal ribs, as soon as they lose their tubercles. Others which have no tubercles acquire this aspect at still earlier age, and these lead into *Steph. macrocephalum*, in which the young are invariably smooth, or not tuberculated.

In *Steph. macrocephalum* we find a series of forms, which become gradually more and more compressed laterally, until they present a very narrow abdomen and whorls of extraordinary breadth. The abdomen, however, does not become sharp, even in extreme varieties.

Throughout this series, as a rule, only the oldest specimens become smooth on the latter part of the living chamber, showing that this is an old age characteristic. The growth maintains the same ratio of increase in the size of the animal throughout life, and the whorl therefore never becomes contracted even in extreme old age. There is, however, here, as in the compressed forms of other series, a noticable decrease in the size of the species or varieties as a whole. The laterally compressed forms are usually much smaller than the broad abdomened forms, a fact in direct accordance with the idea that they are the senile descendants of the broader forms.

The mouths of this series, like those of all species previously described, present no lappets at any stage of growth, and are very uniform in outline.

Steph. Brocchii is a species with very peculiar characteristics, and its affinities lead in two directions; one towards *Steph. platystomum*, and the other towards *Steph. Gervilii*, and other senile forms.

Some of the varieties do not appear to contract the living chamber at all, or only the very last portion near the mouth. These have the precise aspect of the young of the finer ribbed varieties of *Herveyi*. Others show this contraction in such a marked manner that the inference becomes unavoidable that the living chamber has a tendency to become like that of *Gervilii.*

Starting from these Gervilii-like varieties of *Brocchii,* a series can be followed which leads imperceptibly into *Gervilii* proper with its coarse ribs even in the younger stages, and from thence into the smooth, globular, and more involute forms of *Steph. Brongniartii.*

The series from *Gervilii* to *microstomum* is not so complete, but I think no one can examine the forms in Prof. Mœsch's collection, the *Amm. Ymir* of Oppel from the Parkinsoni-bed, without coming to the conclusion that they show characteristics intermediate between true *Gervilii* of the Humphriesianus-bed and the *Steph. microstomum* of the Macrocephalus-bed. The form, size, ribs, and the fact, that in many specimens *microstomum,* like *Gervilii*, does not become smooth on the living chamber, except in old specimens, while in others the form is much more altered and smoother at comparatively early age, are all intermediate characteristics. Their meaning, however, was not perceptible to me until I had become assured that true *microstomum* had no lappets, and was found as the variety, *Ymir*, geologically lower than the typical form.

The peculiarities of the larger Gervilii-like varieties of *Brocchii* are exaggerated in the succeeding *platystomum* forms, in which the living chamber presents the irregular form at a very early age, and is usually smooth and much compressed laterally near the mouth. The evidence appears to show that there is a line of forms leading from the smaller *Gervilii* and *Brongniartii* through variety *Ymir* in the Parkinsoni-bed to *microstomum* in the Macrocephalus-bed, and also a line which connects the larger *Brocchii* through their Gervilii-like forms, with the true stout-formed *platystomum* of the same bed. The latter is more deficient than the former, since there are no intermediate forms in the Parkinsoni-bed, but this is largely made up for by the close resemblances of some of the adult forms, and of the young of this species to the adults of the normal or untuberculated variety of Brocchii. This view of the affinities also explains better than any other the very close similarity of the stout form of the shells throughout, and the peculiar aspect of the living chamber.

Throughout the whole of these series we find similar phenomena to those occurring in the series which spring from *subcoronatum.* Wherever growth is continuous throughout life, old age does not act very distinctly upon the shell in the obsolescence of the ribs or decrease in size of the whorl as a whorl, either in the individual or in the series to which the individual belongs. This was shown particularly in the *macrocephalum* series, which continued the direct line of those varieties which began with the true *contractum* forms in which the mouth showed little or no contraction. Other series, however, which were followed out from those varieties of *Brocchii* which did show this contraction, manifested a distinct tendency. It was found that in the same variety the living chamber varied not only in different individuals, but at different stages in the same individual. In the young it showed far less the tendency to contract and to become smooth than it did in the old age of individuals of the same varieties. The contraction and smoothness were also less apparent in the earlier or ancestral forms than in the more mature or descendant forms, whether found in the same formation or in distinct formations. Thus following out from *Brocchii* to *Brongniartii*, we find a series steadily decreasing in size, in the regularity of the growth of the shell, and in the size and prominence of the ribs. The contraction and smoothness of the living chamber, at first a variable characteristic, only found in the senile stages of large specimens, become fixed as adult characteristics of all forms in the Gervilii-like varieties of *Brocchii*, are inherited according to the law of acceleration in the living chambers of *Gervilii* at an earlier age, and finally constantly appear accompanied by all their attendant degradational or senile characteristics at a much earlier period in *Steph. Brongniartii.*

The series from *Brocchii* to *microstomum*, and also to *platystomum*, were not worked out in accordance with this theory from "*a priori*" conclusions, but were traced out in accordance with the evidence, and the true relationship not suspected until these remarks were written; nevertheless the same principles appear to hold in them, but not so well or distinctly marked.

The *microstomum* series maintains more determinedly the ancestral *Gervilii* type so far as the aspect of the ribs is concerned, but obeys the same law in the lateral flattening of the living chamber and increasing smoothness of the species.

Steph. platystomum is, however, a notable example of the action of the law of acceleration, since here the smoothness and distortion of the living chamber become constant at a very much earlier age than they ever appear in the large Gervilii-like varieties of *Brocchii*, which, according to Quenstedt's and my own independent observations, must be the immediate progenitor.

Steph. dimorphum constitutes a series by itself, or rather it might be said begins one of which it is the only known member. The evidence afforded by the earlier stages of growth indicates a close affinity with *Brocchii*, since the shell evidently continued to increase the size of the living chamber until the adult period. At this stage it began to exhibit very markedly the contraction previously described. The presence of the furrows also shows that this living chamber was never absorbed to any great extent; a very remarkable difference when we consider, that if the furrows were absent many English specimens would be inseparable from *microstomum* in Dorsetshire, and others found in Calvados, undistinguishable from *Brongniartii* of the same locality, and that both of these species habitually absorb the living chamber after every arrest of growth. The mouth outlines agree with those of the preceding series.

The next and last series with which we have to deal is also the most extraordinary.

Step by step, in spite of preconceived notions, the evidence has forced me to refer the whole of these series, which spring from *contractum*, to *Steph. subcoronatum* as the parent form, and this is the case here also.

The connection of *Steph. Braikenridgii* with this species is equally plain, although the large lappets are so distinct that an independent origin might have been reasonably anticipated. The resemblances of the young of *Steph. Braikenridgii*, to the young and adult of *Steph. subcoronatum* are too plain to admit of much doubt, and it is probable that the blank which still exists will be filled, as it has been in the genetic history of *Amm. fuscus* by Quenstedt, by the discovery of intermediate forms having the mouth lappets as a variable or simply adult characteristic. The young of *Steph. Braikenridgii* resemble the adults of *subcoronatum*, with the exception of the contraction of the living chamber. This takes place in young specimens, however, much more slightly when an inch or half an inch in diameter than it does in the full grown, and at no period does it equal the distortion common in the next member of the series, *Steph. Sauzei*. The mouths of both species not only have the lappets, but these are peculiar in arising from the abdomen and spreading out abdominally instead of laterally, in correllation with the abdominal flattening of the outline, which gives the shells a totally distinct aspect from those of any other series. *Steph. Sauzei* accelerates the inheritance of the *subcoronatum* form so much that it is difficult to recognize the affinity with *Steph. Braikenridgii* in those varieties which grow rapidly in size and have narrow umbilici. In others the *subcoronatum* form is more plainly discernible. This is precisely similar to the relationship which exists between *Brongniartii* and *Gervilii*.

A review of the general relations of the different series exhibits some peculiarities worthy of our attention. If we start from *Steph. nodosum* and compare the different species of each genetic twig or branch, we are struck with the very distinct characteristics of each series of forms.

Steph. Bayleanum is decidedly retrogressive, the size and the involution of the whorls is less than in the type of *nodosum*. *Humphriesianum*, on the other hand, acquires in successive forms finer ribs, rounds the whorls of the adult and increases the amount of the involution, and, in the highest forms, the elevation of the abdomen. *Steph. subcoronatum* holds more closely to the type of *Steph. nodosum*, and forms the centre of affinities for all the remaining groups.

The comparison of these three main groups also reveals the very interesting fact that *Bayleanum* and *Humphriesianum* have no descendants; only the last of the three mentioned, *subcoronatum*, appears to have been fruitful in this respect. *Bayleanum*, in the course of its growth, contracts the whorls at an early stage, thus replacing the Pettos-like form by a more flattened, discoidal whorl in the adult stage. *Humphriesianum*, on the contrary, increases in the relative size of the whorls for a considerable time, but sooner or later shows the effects of the contraction of the mouth parts, which appears at first as a transitory characteristic near the mouth of each newly formed living chamber. This contracted part is completely absorbed in the younger and adult stages, when growth is resumed after each season of rest, but not in the old. Therefore after a period more or less prolonged, according to the size and growth force of the specimen, the shell begins to diminish in the size of the whorl and the involution to decrease. This eventually, becomes very marked, especially when it is accompanied, as it must be in extremely old specimens, by the loss of the spines and ribs. The Pettos-like form is retained for a longer period in the young than in *Bayleanum*.

Steph. subcoronatum, on the other hand, retains the Pettos-like form much longer than the other two, shows hardly any signs of decrease in the rate of increase in the size of the whorl by growth, and therefore presents in many specimens no very marked old age changes in the shells. It is altogether more like the parental *nodosum* or *Pettos* than any other form. This fact is very significant when we observe how completely it appears to be the genetic source or origin from which spring all the other forms of the group.

If this were an isolated result I should be slow to attach much importance to it, but I am constantly confronted in these researches by the fact, not only that the simplest or most embryonic forms, those standing nearest to the source or roots of a group, are the most prolific; but often that those among their direct descendants which retain this simple structure are the longest lived, most enduring and least changeable of all others. Compare for instance, the slight differences existing between *Steph. subleve* in the Athleta-bed, and *Steph. subcoronatum* or *Blagdeni* in the Humphriesianus-bed, with those between the same species and *macrocephalum* or *platystomum* or *Sauzei*; also the longer existence of this series with that of the other and more changeable series.

Not only are the changes observable in the whole series from *subcoronatum* to *subleve* less marked, but this necessarily correllates with the changes in the course of individual development and growth which are also less marked; there is less force used up in the produc tion of new characteristics in the ancestral forms, and therefore a greater capacity for propagation and resistance to the modifying effects of changing conditions of climate and habitat. The forms of *subcoronatum*, which exhibit no marks of senility even when very large, lead directly into the true *Blagdeni* forms. On the other hand, those which change much in old age exhibit intermediate stages, in which the abdomen becomes rounded and more elevated, and the ribs similar to those of *Deslongchampsii.* Though not able to trace this connection so fully as the others, there seems to be reasonable ground for joining *plicatissimum* with *Deslongchampsii*, since both of these exhibit similar characteristics.

In following the *coronatum* series from *Blagdeni*, we are struck by the gradations which gradually lead the observer from the immature form of *Blagdeni* to the flat-sided, untuberculated form of *planulum*, with its elevated abdomen. This, as I have previously pointed out, is a direct repetition of the retrogressive old age characteristics of the individual, as shown in *Humphriesianum*, and in some specimens of *subcoronatum.*

The individuals of one series, the *macrocephalum* series, show old age only in the elevation and narrowing of the abdomen. There is here but a slight retrogression, so far as the individual is concerned.

The size of the individual continues to increase during life, there is no distortion, and only a normal tendency to the suppression of the ribs. So far as the series, however, is concerned, the size of the later occurring species or normal senile forms is smaller than that of the average of the ancestral forms.

The senile forms of this series and of the *coronatum* series express in the continuous increase of the individual by growth throughout life, and in the absence of all decrease in the amount of involution, a certain power to resist the retrogressive changes which are so marked in other series. The suppression of the tubercles, however, and the narrowing of the abdomen and decrease in absolute size of the terminal species of the series are decisively senile. There is evidently a mingling of opposing tendencies in these forms not found in the senile forms of series, which are more completely changed. Thus in the series from *Brocchii* to *Brongniartii*, there is not only a retrogression in absolute size, but also in the increasing distortion of the living chamber. The period at which the living chamber begins to show a distorted form and smooth exterior, becomes earlier in each species. This is also true of the series leading into *microstomum* and *platystomum*, which present similar characteristics.

In *dimorphum*, however, which appears to be one of this group, a remarkable difference makes its appearance. The living chamber is no longer fully absorbed after each period of arrest in the growth, and an abdominal channel, which was only occasionally visible in some of the *planulum* forms, becomes quite constant. Nothwithstanding these new characteristics, the form is evidently retrograde and senile, suffering in some individuals from a very rapid series of senile degradations. This is probably due to the declining force, which prevents the animal from resorbing the walls of the living chamber. A similar state of affairs occurs in the *Sauzei* series, where a new characteristic is added in the shape of mouth lappets, but the inheritance of the distorted form of the living chamber takes place, as in the Brongniartiian series.

Every one of these series presents three principal stages of growth and development, the young or Pettos-like, the adult, or that in which Humphriesianum-like ribs and tubercles and a rounded abdomen appear, and an old age or senile period, in which these ornaments tend to disappear, the shell to decrease in size, and so on. These three stages are present in different proportions in different series. Thus the manifestations of a retrogressive tendency in *Bay-*

leanum are much more prominent than in *Humphriesianum* and *macrocephalum*; and the changes introduced are very distinct in these from what they are in the distorted forms of *Brongniartii* and others; again, the Pettos-like form is retained in the full grown and even old specimens of the lower forms of the *coronatum* and *subleve* series, whereas it is only a characteristic of the development of the young in other series.

In fact, the manifestations are exceedingly complicated, and prevent the application of the three stages to the solution of the affinities and to the classification of the genus as a whole, except in a very general way. Thus it may be said that all the lower members of the genus, *Steph. nodosum* and *subcoronatum* and *contractum* are similar to *Pettos*, and that the higher, such as *planulum*, *macrocephalum*, *Brongniartii*, etc., exhibit during the adult period senile characteristics corresponding to the senile characteristics of the individual.. But this can only be asserted as we have seen with considerable qualification until each genetic series is considered by itself, then indeed an exact correspondence comes to light between the senility of an ancestor and the senility of the descendant or congeneric species.

This statement exhibits completely the difference between geratology[1] and embryology. With the former it is possible to indicate *only* what must have been the dying forms of the particular genetic series to which the individual belonged, whereas with the assistance of embryology and the history of the younger stages we can with equal probability point out an unknown ancestral form for all the series of a group. The right use of both the correspondences of embryology and of geratology gives the means of mapping out with considerable probability both the past and future of groups from the study of even a limited number of individuals.

The laws of heredity secure the constant inheritance of the adult characteristics of the parents at earlier and earlier periods in successive descendants, until the permanent characteristics of an adult ancestor, or what remains of them, becomes embryological. This tendency to constantly reproduce similar characteristics in successive

[1] From γῆρας -ατος, old age, and λόγος. I have adopted this new term with considerable hesitation and doubt, and have only done so under the pressure of necessity. In no other way can I better convey my conviction that there is a traceable correspondence between all manifestations of decline in the individual and in the group to which the individual belongs, which may, like embryology, be used inductively in reasoning upon the probable affinities of animals.

generations of individuals, has been heretofore supposed to be confined to the inheritance of adult characteristics, or to those characteristics which make their appearance in the parents previous to the period of reproduction.

Heretofore it has also been generally assumed that only the active elements of the growth of the parts and their tendency to the more or less powerful performance of certain functions were necessarily inherited. It has not, so far as I know, been even hinted at that animals could also inherit a tendency to change in a way that was unfavorable to the continued existence of a race or group as a whole. This is, however, not an isolated but a very general fact among the Ammonites. The successive species in almost all large groups sooner or later inherit the old age tendencies of their ancestors so completely, that they manifest these even in their early stages. In other words, they never attain a stage which can be closely compared with the adult stages of the most common or characteristic of the ancestral forms. This is left out. The embryo passes into the young, and the young proceeds by growth to develop parts and organs entirely wanting in those characteristics which distinguished the similar parts and organs of the adults of the ancestral forms. When we compare these accelerated forms, or forms which have thus skipped some of the previously existing stages of their ancestors, with the senile stages of those same ancestral forms, they present a correspondence of greater or less exactness, according to their affinities, sometimes very perfect, sometimes very remote. Thus the old age stages of one of the Arietidæ do not at all closely resemble those of *Humphriesianum*; the complete correspondences are limited to genetically connected series or groups, *and sometimes only to organs or certain sets of organs* which alone show the effects of senility in the individuals and in the group. The fact of the inheritance of old age characteristics, and of the extinction of types as shown in this way, is, however, of general application, and will probably be found in all departments of the animal kingdom.

Of course it will be readily understood that these statements apply only to the most perfect groups, or those which complete their cycles of forms. It is not intended to assert that every group has an old age, or even that every individual has; on the contrary, there are some forms in nearly every large group among the earliest ancestors which manifest senility very slightly, though attaining a very large size, and there are some groups which show only a partial decline, or none at all. All of these exceptions, however, can be accounted for by natural causes, and the comparison between the life of the group and the life of the individual is rendered even closer and more distinct thereby. I have frequently, in former publications, referred to these facts, and am interested in them now only in their application to the present group.

We find in looking at the table (p. 366) that all the series sprang from one ancestral form, and that as in many other cases among Ammonoids, the genesis of the forms must have proceeded with comparative rapidity. This of course means with reference not to the number of years, but to the portion of geological time occupied by a series. Thus the whole of the time during which the Oolites were being deposited, was not needed in order to produce the extreme forms of the *Sauzei* group by evolution out of *nodosum*; on the contrary, one single bed contains the entire record of their existence, one minor period alone was amply sufficient for the evolution of the most aberrant form of the whole genus.

If we assume that certain characteristics which show themselves for the first time in the organization of *Steph. Humphriesianum*, *subcoronatum*, *contractum*, etc., were favorable to these forms, and particularly fitted them to sustain existence in these different localities and with distinct physical surroundings; and that these different characteristics were directly due to the necessity of the plastic organization to flow into and fill up certain vacancies, and fit itself to fill these vacancies more and more completely, we can understand how the differences which distinguish the forms have arisen. Thus the peculiar lappets of the rim of the mouth in *Steph. Sauzei*, and the numerous local peculiarities of appearing here and there in the history of every fauna, which are merely varietal and not characteristic of the series or even of the species, could be accounted for. They are characteristics which suddenly appear without having had existence previously in ancestral forms.

Besides these, however, there are numerous other characteristics, those which are derived from ancestral forms and are mostly confined to the young, such as the Pettos-form and characteristics. These are permanent and hereditary, and apparently independent of the surroundings in proportion to the antiquity of their source. Thus the extreme bag-like embryo is invariably present, and there is every intermediate grade from this to the full Pettos-like form and tubercles, etc., which last, on account of their recent origin, are, according to the law of acceleration, entirely omitted in the development of the individuals of some of the completely senile or later occurring species. The form of the embryo and the Nautiloid and Goniatitic stages which were variable characteristics during the Silurian and Devonian, have become more or less fixed and permanent by constant inheritance, and are at this period in the existence of the Ammonoids, either partially or entirely independent of the action of the physical surroundings, occurring in the embryonic or early stages of the development of the individual, however different its habitat. I do not mean, of course, to assert that even the most invariable of these hereditary characteristics did not arise primarily as the direct product of physical causes, but simply to point out their existing independence, after having become through continued heredity a permanent part of the growth tendencies of the group. The proofs of this have been given in my paper on the "Embryology of the Cephalopods," in which the gradual manner in which the characteristics become less and less subject to variability in the embryo is given in detail.

The differences, then, or those characteristics distinguishing the different series from each other when they first appear, must be largely confined to the adult period in the existence of the individual or to the later stages of the growth of the young, and this is a corollary of the proposition that the differences between the forms are due to the direct action of different physical surroundings upon similar organisms. For if the differences were thus produced we should necessarily anticipate that they would make their first appearance, in most cases at least, after the permanent and hereditary characteristics had been fully developed. In common with Prof. Cope I have repeatedly explained these and other related phenomena, by what we have called the law of acceleration. [It is a universal law of heredity, that previously elaborated, ancestral characteristics tend to be inherited, if inherited at all, at earlier and earlier stages in successive descendants, until they either finally disappear like the Pettos-form in the young *Sauzei*, or become fixed and more or less permanent in the embryo.

Laying aside all of these, we can now turn our attention again to strictly senile characteristics. These are the representative forms which are produced in every series. That is to say, there is a certain parallelism produced by the perpetual reappearance or genesis of similar forms in distinct structural series, and as might be anticipated, these are due to similar causes, disease, either normal or abnormal, produced by the continued action of unfavorable surroundings on the individual. That old age is a normal disease, or that it at least should be classed with pathological phenomena, can hardly be questioned. If it were questioned, however, the similarities between distorted forms occurring in unfavorable situations and the normal retrogressive changes of old age in a well formed individual of the same series, would settle the dispute; the products of the direct action of disease produced by unfavorable surroundings, and often even by wounds and those due to senility have a wonderful similarity. These senile characteristics may appear, as in *Steph. Bayleanum*, as probably the result of the direct action of certain unknown, but unfavorable causes, upon the organization of *nodosum*, or only slightly, as in *Steph. Humphriesianum* or not at all, as in *Steph. Blagdeni*, which as a descendant of *Steph. subcoronatum* ought, unless sustained by some exceptionally favorable surroundings, to show decisive marks of senility. This case, and that of *Steph. macrocephalum* previously cited, show that the normal retrogressive tendency of old age may occasionally be to some extent counteracted by the process of growth, as shown by the increase in growth of the shell, even in old age, of these two species. This, of course, can only be attributable to some exceptionally favorable circumstances, which for a time give extraordinary power to the organization. But this is only for a time, since in all series having a prolonged existence, old age forms eventually make their appearance just as senile characteristics do in the individual.

Wherever the old age or diseased tendencies make their appearance they tend to the production of similar forms. If mitigated by the very favorable circumstances under which the race is living, and the shell, in consequence of the unimpaired powers of assimilation of the animal, continues to increase proportionally in size and in the involution of the whorls throughout life, we find that a narrow-abdomened, convergent-sided and very involute whorl is evolved in the last or highest members of the series, whether it comes from the round abdomened, or the keeled or channelled groups. If, however, the surroundings are not especially favorable, and the assimilative powers become impaired, as shown at first by the decrease in size of the whorl in the old age of the individual, then all degrees of irregularity in the whorl become manifest in the last or highest members of the series, tending to the production of Scaphitoid forms.

This, in many series, is probably due to the direct inheritance of the tendency to reproduce the old age characteristics of ancestors, according to the law of acceleration at earlier and earlier periods in successive descendants, and is the normal form of the decline of genetic series; but besides this there are in some species corresponding series of forms, evidently due to the unfavorable nature of their surroundings, which are so quickly produced as to have the effect of simultaneity, as if they sprang at once from one brood. The former may be compared to the normal disease or senile period of a healthy individual, and the latter to the premature old age of an unhealthy or prematurely developed individual.

In the embryo, therefore, we find permanency and exact hereditary similarity; in the later stages of the young and the adult, the novelties of adaptation to new or varied surroundings; and in the old or senile periods, a diseased condition, in which these adaptations or novelties tend to be absorbed or lost, and consequently greater uniformity is noticeable between the old than between adults.

This precisely corresponds to the relations of a group composed of several series derived from a common ancestor. At first, near the point of origin, the series are similar organically, then great structural and morphological divergence takes place, and finally, though they remain structually just as remote, similar forms begin to make their appearance in the different series.

I might go on endlessly with these comparisons, but it suffices to say that the conclusions which I published in 1866, in the Memoirs of this Society,— asserting that the life of an individual, and the life of the genetically connected series to which the individual belonged, could be directly correllated, that a series, like an individual, had only a limited force available for growth, development and propagation, that the three stages of existence in the individual corresponded respectively, the young to the past, the adult to the present, and the senile to the future of the group, whatever it might be to which the individual belonged,— have been confirmed by the minute analysis of the groups of Jurassic Ammonites, and the more minute the analysis the more complete the correspondence.

Note. — Having used the word force in this essay with a very distinct meaning from that with which I first used it in 1866, it becomes necessary to define it. Organic force or vital force is, in my view, simply an expression for the force resulting from the combination of chemical elements in an organic form.

FIRST SERIES.

Stephanoceras Bayleanum.

Amm. Bayleanus Oppel, Die Juraf., p. 497.

Amm. Humphriesianus D'Orb. (pars), Terr. Jurass., pl. 133.

Oppel did not find the intermediate forms between this species and *Humphriesianum*, and therefore considered it distinct. Although this view is untenable, I retain the specific name in accordance with previous custom, otherwise I should be obliged to use a trinomial designation for this form, and others of the same group. The transition forms from this to the next described, are numerous, and can be observed in any large collection. The young were not observed. According to Oppel, it is found lower than *Humphriesianum* in Germany.

Stephanoceras nodosum.

Var. *Humphriesianus nodosus* Quenst., Der Jura, pl. 54, f. 4.

Amm. Humphriesianus Sow., Min. Conch., pl. 500, fig. 3 (not 1–2).

The typical form of this variety has more prominent tubercles and fewer lateral ribs than the typical variety of *Humphriesianum*. The young also resemble the adults of *Blagdeni* until a later period of growth than in the last mentioned. All these characteristics are subject to great variation, and both by the adult characteristics and development these forms fade into the next described. It occurs in the Mus. Stuttgart Coll., associated with *Sauzei* in the Middle Brown Jura γ. The originals in Sowerby's collection show that the large specimen figured on pl. 500, fig. 3, of his Min. Conch., must be included in this variety, while figs. 1 and 2 must be referred, as they have been, to *subcoronatum*.

Stephanoceras Humphriesianum.

Amm. Humphriesianus Auct.

Var. *Humphriesianus plicatus* Quenst., Der Jura, p. 398.

Amm. Humphriesianus D'Orb., Terr. Jurass., pl. 134–135.

The typical forms are found in the Middle Brown Jura and in the Mus. Stutt. Coll., with the first of the true *coronatum* forms. The varieties appear to have two principal tendencies, one which leads into forms similar to *Humphriesianus plicatissimus* Quenst., and occurs in the upper part of the same formation (*oberer Delta*), and one which approximates to the *Amm. subcoronatus* Oppel. One fine specimen of this form showed an incomplete living chamber at the diameter of 156 mm., about half a volution in length. This was smaller in every way than the adjoining whorls, but no signs of old age were visible. The finest suites of this species occur at the Bristol Museum and in D'Orbigny's collection.

One specimen in the latter shows an extremely long and complete living chamber, occupying one and one quarter volutions. The entire diameter of the specimen was 210 mm. The involution of the whorls was noticeably decreasing at about 30 mm., and continued steadily to decrease, accompanied by a corresponding diminution in the size of the whorl until the difference in size and form at the mouth became very marked. This specimen exhibited an extreme variation, and should be more exactly, perhaps, associated with *nodosum.* In other stouter and more normal forms the involution decreases at a slower rate, and begins later in the life of the individual, and in some individuals it is not perceptible at all. It is evident that either no absorption of the living chamber takes place, or only a partial one took place during the growth, since the diminution in the size of the living chamber simply continues that which occurs in the body of the shells, where the sutures are well marked. This may be noticed in any large collection of this species. A fragment of the mouth of a specimen which must have attained a diameter of at least 300 mm., still possessed the tubercles and shewed no signs of old age beyond this decrease in diameter. In Dr. Wright's collection a fine specimen (size not noted) exhibited the living chamber and mouth complete; the last whorl was smooth for almost the entire length, the tubercles and ribs small in the adult.

SECOND SERIES.

Stephanoceras subcoronatum.

Amm. subcoronatus Oppel, Jahressch. Nat. Wurtt., Vol. 12, p. 496.

Amm. coronatus-oolithicus Quenst., Die Ceph., pl. 14, f. 4.

Amm. Humphriesianus Sow., Min. Conch., pl. 500, fig. 1–2 (not 3).

This species is distinguished from *nodosum* only by the greater proportionate breadth and flatness of the abdomen, and the abruptness of the umbilical sides, continuous increase in the size of the whorls by growth, finer ribs, and so on. These characteristics may be summed up in a few words as precisely intermediate between *nodosum* and *Blagdeni.* The adults are smaller, but quite similar to the latter, and though larger than the young of *Humphriesianum,* almost identical with them in aspect externally, though probably differing in the characteristics of the sutures. The similarity of this species to *Braikenridgii* is delusive; its true affinities place it nearer to *nodosum.* The resemblance is due to the retention of the common ancestral Pettos-like form until a late stage of growth, or during the entire life of the individual.

The various changes taking place by growth and development may be studied in any large collection. The contraction of the whorls in size, and the consequent assumption of rotundity, take place in some specimens very markedly, and make them look very like *nodosum.* This change is so great in some very old specimens that they resemble the adult of *Bayleanum*, though their own adult stage, or younger periods, have the normal form of the true *subcoronatum.* In many other specimens, however, though of equal size and apparently the same age, there are no perceptible marks of such changes either in the size, form of the whorls, or ornaments.

Stephanoceras Deslongchampsii.

Amm. Deslongchampsii D'Orb., Terr. Jurass., pl. 138.

This is evidently a form of the broad abdomened variety of *subcoronatum* with prominent spines, described by Quenstedt as a variety of *Humphriesianum*, and as a transition to the *Amm. subcoronatus* of Oppel. A remarkably fine specimen in Quenstedt's collection, from St. Vigor, enabled me to make this comparison. I did not find the original in D'Orbigny's Collection. Quenstedt places it in the *Braikenridgii* series, to which it appears to be allied by the curvature and general aspect of the ribs, but this resemblance it shares in common with forms of the *subcoronatum* series, especially *plicatissimum.* The abdomen becomes considerably elevated, and the sides convergent in the adults.

Stephanoceras plicatissimum.

Amm. Humph. plicatissimus Quenst., Der Jura, pl. 54, f. 3.

This variety has so close a resemblance to *S. linguiferum* in some forms that broken specimens are frequently confounded under the same name. There is a very close resemblance in the sparseness of the lateral ribs, and comparative closeness and fineness of the abdominal ribs, the prominent tubercles and the form of the whorl. The mouth lappets, however, the intermediate forms and the young of *linguiferum* show its affinity with *Steph. Sauzei* to be unquestionble, and separate it widely from this species. Further comparisons show that the real affinities of *plicatissimum* lie with the stouter forms of *subcoronatum*, which have been described as closely approximating to *Humphriesianum*, from which it is sometimes difficult to separate it. It is really a variety of *Deslongchampsii*, with more elevated abdomen and narrower umbilicus.

THIRD SERIES.

Stephanoceras Blagdeni.

Amm. Blagdeni Sow., Min. Conch., pl. 201.

Amm. coronatus Zieten, Verst. Wurtt., pl. 1, fig. 1.

Amm. Blagdeni D'Orb., Terr. Jurass., pl. 182.

Amm. coronatus Quenst., Die Ceph., pl. 14, f. 1.

This species, though attaining a large size with fewer whorls, has a most remarkably close resemblance to the ancestral form, *Cœloceras Pettos*, so close indeed that they are very similar, not only in the form and characteristics of the adults, but in the sutures, and in the general history of the development of the yonng. This greater similarity is directly traceable to the very obvious fact that in this variety of the species the immature Pettos-like form, characteristics and sutures, which are common also to the younger stages of all other forms of this genus, are here more strictly retained throughout the entire growth of the animal. This is so strictly carried out, that the shell in most specimens manifests none of the old age characteristics or retrograde metamorphoses previously described in other species, *i. e.*, in the decrease of the amount of involution and size of the whorls. In other specimens great changes take place, but they are very distinct from those of the purely *Humphriesianum* forms. They are first manifested in the elevation of the abdomen, which becomes rounder and more elevated during growth, and the adults become similar to some forms of the next described species. The amount of the involution does not decrease, nor the relative size of the whorl, but the abdomen becomes more elevated and the sides rounder. These forms are similar to *nodosum* in general appearance, but their real affinity with *coronatum* alone stands the test of close analysis.

Stephanoceras coronatum.

Amm. coronatus Brug., Ency. Meth., p. 43.

This species always has in the young, for periods of variable length, according to the variety, whorls which closely resemble in form and characteristics those of the adult of *Blagdeni*.

Variety *Banksii.*

Amm. coronatus D'Orb., Terr. Jurass., pl. 168 (not 169).

Amm. Banksii Sow., Min. Conch., pl. 200.

Amm. anceps-ornati Quenst., Die Ceph., pl. 14, fig. 5.

This variety retains the Pettos-like form in some specimens until a very late period of growth, and in others a close approximation to the next described variety occurs by the elevation of the abdomen in course of growth, and the gradual rounding of the sides and loss of the tubercles. In Sowerby's collection the original specimen exhibits these characteristics only on the last whorl for a limited space, although the specimen attains the large size of 250 mm. in diameter. In the Mus. C. Z. collection one specimen attains the diameter of 220 mm., but exhibits old age only in a slight rounding off of the tubercular projections; in this the sutures are plainly visible throughout. In other specimens, also, the sutures are exhibited in similar relations to the metamorphosed tubercles and form, showing that complete absorption of the living chamber does not occur during growth, and that these changes are truly permanent and retrograde. A form intermediate between these broader and more Blagdeni-like forms and those of the Ornathenthon, or Brown Jura, ζ, occurs in the collection of the Museum of Stuttgart in the Parkinsoni-bed.

The *anceps-ornati* of Quenstedt is in no sense a true *anceps*. It is very similar to "*anceps*," but a close inspection indicates, first, that there are no intermediate forms between the two, and second, that the form in the Museum of Stuttgart, as above quoted, seems to show that it is genetically linked with the Banksii- and Blagdeni-like varieties of the earlier *coronatum* forms. It is found in the upper part of the Athleta-bed, in the Museum of Stuttgart collection, associated with *Bel. hastatus.*

Stephanoceras planulum.

Amm. planula D'Orb., Terr. Jurass., pl. 144.

This name is quoted by Oppel, as that of a new species, *Amm. Wagneri*; but Oppel's comparison shows that he supposed D'Orbigny's figure to represent a species closely allied to "*arbustigerus*," whereas it very accurately shows the characteristics of a well known French form which passes insensibly into "*coronatus*," and is found associated with the latter at Chatillon sur Saone in the Bath-formation of Oppel. The originals do not exist in D'Orbigny's collection, but young specimens show that their relations are probably correctly stated, as above.

FOURTH SERIES.

Stephanoceras subleve.

Amm. sublevis Sow., Min. Conch., pl. 54.

Amm. modiolaris D'Orb., Terr. Juras., pl. 170.

Amm. sublevis Quenst., Die Ceph., pl. 14, f. 6.

Amm. sublevis Zieten, Verst. Wurtt., pl. 28, fig. 5.

The originals in Sowerby's collection prove the accuracy of Quenstedt's conclusions with regard to the identity of the English, French and German forms. D'Orbigny's collection possesses only a cast, but his figures are quite sufficient.

Amm. sublevis Zieten, which Quenstedt identifies with *modiolaris*, is represented by several specimens in the Upper Brown Jura, Machrochilus-bed, Museum of Stuttgart. One of these is much thinner than the others, and shows a more discoidal young. The rest have very abrupt sides from an early period, and deep umbilicus, but not so deep as in D'Orbigny's figure. These show that the form is not developed as in *Quenstedioceras Leachii*, and others of the *Goliathus* group, to which the adult of the *modiolare* variety seems to be closely allied, but according to the method commonly observed in the *coronatum* group.

A very fine suite of this species exists in Quenstedt's collection, from which I obtained the following observations. One variety retains until a late stage of growth a very close resemblance in form and characteristics to the *coronatum* as figured by D'Orbigny, and which has been cited from the Parkinsoni-bed in the collection of the Museum of Stuttgart. Whether the whorl ever becomes entirely smooth in this variety I cannot say; they attain a considerable size without any marks of such a retrograde metamorphosis. The umbilicus is quite open, and the young in form and characteristics approximate to the adult of *coronatum*. A second variety may be distinguished, which is a true *subleve* form, but still has quite an open umbilicus. This loses its ribs and becomes smooth at a late period of growth on the abdomen, but retains heavy lateral ribs. A third variety has an open umbilicus, but is comparatively smooth at an early age, losing the lateral as well as the abdominal pilæ, and finally the whorl begins to show a retrograde metamorphosis, the size being affected by contraction, as in large specimens of *Steph. Gervilii* or *Steph. Humphriesianum*. A fourth variety has the narrow funnel-shaped umbilici, and the individuals appear to continue to increase in size throughout life without any contraction in the magnitude of the whorls. These are also smooth in the adult.

The resemblance of the young of the first varieties to *coronatum*, and the mode of growth and subsequent retrograde metamorphosis by a decrease in size, shows that we are dealing with forms derived from the *coronatum* series, and which, notwithstanding the close resemblance of the fourth, or *modiolare* variety, to *Amm. Lalandeanus*, do not seem to lead into this group.

FIFTH SERIES.

Stephanoceras contractum.

Amm. contractus Sow. (pars.), Min. Conch., pl. 500.

Under this name I have, for convenience sake, assembled those forms which are intermediate between *subcoronatum* and the *macrocephalum*, *Brocchii* and *Sauzei* series. They are usually recognized in collections, either as varieties of *subcoronatum*, as *Brocchii*, as *linguiferum*, as *Humphriesianum*, etc., and also as true *contractum*. From this they vary, however, in the fineness of the abdominal ribs and the immature aspect of the lateral ribs. This last characteristic is so marked that the umbilicus resembles that of *Pettos* very closely in the smooth, abrupt aspect of the sides, and the prominence of the tubercles. The varieties lead from a very open discoidal whorl in one direction into the true *Brocchii* form, and in another into the *Braikenridgii*.

Stephanoceras Herveyi.

Amm. Herveyi Sow., Min. Conch., pl. 195.

" " Ziet., Verst. Wurtt., pl. 14, f. 3.

The young of this species varies considerably in aspect. Some specimens have a row of prominent tubercles on the side, closely appressed so as to form an almost continuous ridge. Others have them more scattered, and finally there are many without any, and wholly indistinguishable from the untuberculated young of *Brocchii*, if found in the same formation. They are invariably stouter, rounder, and less Pettos-like than the young, or even adults of the subcoronatum-like varieties of the *contractum* from Dundry, Eng. The peculiar abdominal ribs are in the young no coarser than in *Brocchii*, and it is evidently a lineal descendant of the tuberculated Brocchii-like forms of *Steph. contractum*.

Stephanoceras macrocephalum.

Amm. macrocephalus Schlot., Die Pet., p. 70.

" " Ziet., Verst. Wurt.t, pl. 5, fig. 1.

No line can be drawn between this species and *Herveyi*, which has not many exceptions, but as a rule the forms of *Steph. macrocephalum* may be distinguished by the flatness of the sides and the more elevated abdomen. The young also take on this peculiar form at an early age. Their earlier stages are precisely similar to those of the untuberculated young of certain varieties of *Herveyi.*

The smoothness of the latter part of the living chamber is very perceptible in large specimens of *Herveyi* and of this form, but not in small specimens, though I have seen many small specimens with nearly complete living chambers. This shows that it is an old age characteristic.

SIXTH SERIES.

Stephanoceras Brocchii.

Amm. Brocchii Sow., Min. Conch., pl. 202.

This is a convenient designation for a number of forms which in the young are undistinguishable from the Brocchii-like forms of *contractum,* or rather fade into them. They lose the tubercles of *contractum* at an early period in their growth, and the form grows stouter and more involute, disguising in the adult the resemblance of the young to *contractum.* Series, however, exist, exhibiting all the stages between them, in the British and Bristol Museums, and a partial one in this Museum. The adults differ from *Brongniartii* so slightly that it is equally difficult to decide on that side, but some forms have a peculiarity of the growth which shows considerable distinctness. They continue to grow or increase in size regularly throughout the entire length of the living chamber during the adult period. A specimen in the Museum of Stuttgart, having the coarse ribs and open umbilicus of the forms which approximate most closely to the true *contractum*, has a nearly complete living chamber, but shows no signs of becoming smooth or contracting the aperture. Either it must have had a much longer living chamber than is usual in *Brongniartii*, or possessed these distinguishing characteristics. The true *Brocchii* forms are therefore simply larger and more involute varieties of *contractum*, and in extremely large old specimens when the whorl permanently contracts the shell, they become indistinguishable from the typical *Gervilii*, except by the coarseness of the ribs and the size. There are several fine specimens in Quenstedt's collection, also, which show this very plainly.

There is a very remarkable series of specimens, undoubtedly belonging to this species, which are described by Quenstedt as a fine ribbed variety of *Humphriesianum*. They have no tubercles except at an early age in Brown Jura "γ." The forms in "δ" directly connected with these, show the tubercles even less prominently, while those in "ε" are smooth, like the young of *macrocephalum*. All have the rapid increase by growth in the size of the shell, which is so characteristic of *Brocchii*, as well as the fine ribs and narrower umbilicus. They appear to show a direct connection with *Steph. Herveyi*, but are, in reality, only representative forms, which are direct descendants of *Brocchii*, and resemble *macrocephalum* in the young because of their accelerated development of the ancestral characteristics, leading to the gradual suppression of the Pettos-like form and characteristics which they inherited in a modified form from *contractum*.

Some specimens in the British Museum have very coarse lateral ribs, and others the finer ribs of the specimens which resemble *contractum* in the young. The specimens in the Bristol Museum attain a very large size, and in the largest the last whorl or two becomes so contracted and flattened laterally, that it resembles the forms of the Perisphinctes group.

Another magnificent suite of this species, labelled *Gervilii*, is to be found in the Museum of Stuttgart. They show the same contraction of the mouth in large specimens, in some to such an extent that the actual opening is triangular. The only partially constant distinction which I can find between this species and the true *Gervilii*, consists in the smoothness of the young of the latter, their usually smaller size, and the slower increase in magnitude of the whorls by growth.

Stephanoceras Gervilii.

Amm. Gervilii Sow., Min. Conch., pl. 184*a*, fig. 3.

Amm. Brongniartii D'Orb., Terr. Jurass., pl. 137.

The forms of this species are precisely intermediate in point of size, development, and so on, between *Brochii* and *Brongniartii*. Some of the specimens in the British Museum have finer ribs than the coarser ribbed *Brochii* of that collection, but the umbilicus is quite as open, and it is possible that the young have the same resemblance to the young and adults of *contractum*, but this could not be ascertained. The young of the typical English and German forms are precisely similar to the full grown *Brocchii* of the more contractum-like varieties, aud appear never to have tubercles at any age, being remarkably gibbous even at the earliest stages.

I do not pretend to draw a distinct and definite line on either side of this species, since the indications are numerous that it fades in one direction into true *Brocchii*, and in the other into *Brongniartii*. The latter takes place through the smaller and more involute varieties with globular young and finer ribs. In the Palæontological Collection at Munich there are several species described by Waagen as belonging to Stephanoceras which belong to *Gervilii*, or some of the forms intermediate between this and the true Brocchii forms, such as *Amm. polyschides* and *Amm. polymerus*. *Amm. evolvescens* appears to be a form of *Brongniartii*. The species which occur in the Macrocephalus-bed have been named *Amm. Bombur* Oppel, and it may perhaps be convenient to retain this name, since they seem to be constantly smaller than typical *Gervilii*, but retain the coarser ribs and more open umbilicus of that species in the young.

Stephanoceras Brongniartii.

Amm. Brongniartii Sow., Min. Conch., pl. 184*a*, fig. 2.

Amm. Gervilii D'Orb., Terr. Jurass., pl. 140.

The irregular growth of the living chamber, which resembles so closely that of Scaphites, becomes in this species a fixed character, and is found at an early age, though less marked than in the adults. The young are smooth until a late stage of growth, when compared with those of the preceding species, very globular in form, and the ribs when they begin to appear are very fine and untuberculated.

I find no mention of this species in my notes on D'Orbigny's collection, and doubt if it existed there, since he does not allude to any originals as belonging to his own collection. The lateral expansions figured by him in the early stages are very distinct in position and form from those of the *Sauzei* group. From the study of several specimens of about the same age, I should think they were very much exaggerated in D'Orbigny's drawing. The edge of the mouth is generally bent inwards, but in some specimens it may be thrown outwards, forming a salient angle, but no wings or lappets were observed in the young.

SEVENTH SERIES.

Stephanoceras microstomum.

Amm. microstomus D'Orb., Terr. Jurass., pl. 142, fig. 3–4.

This is a constant and well marked variety, which differs in the young from *Steph. platystomum*. Many specimens at an advanced age do not become smooth on the living chamber, but others do at a comparatively early stage. It never attains the large size or stout whorls of *platystomum*, and the living chamber becomes remarkably flattened laterally. The living chamber is almost entirely absorbed at each renewal of the shell growth.

I find in my notes no mention of any specimen exhibiting the abdominal lappets figured by D'Orbigny, and a strict examination, including the cleaning of several fine specimens, of D'Orbigny's collection, was equally fruitless. Quenstedt also could not find them on the German specimens, and I am therefore forced to the conclusion that D'Orbigny's figure is erroneous in this respect. Several of these specimens had perfect mouth outlines. An examination of the young led me first to suspect that these lappets did not exist, and that the species must belong to the entire mouth series, and I could not understand their appearance in a form so evidently closely related to *platystomum*. A very remarkable series exists in Prof. Mœsch's collection at Zürich. It is the *Amm. Ymir* Oppel, *Amm. bullatus* Kudernatsch, a variety intermediate between *Gervilii* and this species, and found in the Parkinsoni-bed. The living chamber in one specimen is more than one volution in length, smooth for a half of its length, and not yet complete.

EIGHTH SERIES.

Stephanoceras platystomum.

Naut. platystomus Rein., Naut. et Argo., fig. 3.

Amm. platystomus Quenst., Die Ceph., pl. 15, f. 3.

Amm. bullatus D'Orb., Terr. Jurass., pl. 142, f. 1–2.

This species is most admirably described by Quenstedt, and the affinities traced to the coarse ribbed varieties of his *Brongniartii*, which are identical here with *Gervilii*. I have only to add that I have verified his conclusions in several collections, but notably in the Stuttgart and British Museum collections. The resemblance which he describes between the form at certain stages and the *Amm. Goliathus* D'Orb., is certainly quite remarkable, but a close examination shows that it is after all not such as to indicate a genetic connection between them. The angularity of the abdomen of *Amm. Goliathus* is wanting, and the flat abdomen of the earlier stages in that group. The whole development is similar to that of *Brocchii*, and it is only a stouter form of *Gervilii*, with a tendency to form a smooth living chamber.

The living chamber is evidently almost entirely absorbed during the growth of the shell, as may be seen in all large collections. In some specimens of considerable size the living chamber is smooth only for a very short space near the mouth; in others of the same or even smaller dimensions, nearly the whole is smooth. In very large specimens, however, the living chamber appears to be invariably smooth. The irregularity of the growth begins invariably in all specimens near the base of this chamber by the contraction of the whorl, and continues throughout. The increase in size, however, is regular at all preceding periods, whatever the size of the shell. The conclusion is therefore unavoidable, that the living chamber must be almost wholly absorbed in the course of growth. The young are precisely similar to the adults of *Brocchii*.

NINTH SERIES.

Stephanoceras dimorphum.

Amm. dimorphus D'Orb., Terr. Jurass., pl. 141.

The young of this remarkable species at first sight appear to be identical with those of *Brongniartii* or *Gervilii*, but the permanent mouth furrows marking the shell even at an early period, show it to be distinct in its mode of growth. These appear to indicate that the growth of the shell is constant, and that the walls of the living chamber are never absorbed. If so, we have a very remarkable change in the mode of growth. The young evidently retain the Brocchiian living chamber until a late period of growth. That is, the living chamber did not exhibit contraction in the young, but like that of *Brocchii*, continued to increase in size towards the mouth except in old specimens. As the specimen reached the adult condition, however, in this species the chamber assumed the usual proportion of that part in *Brongniartii*, and continued to decrease until the death of the animal. This appears to be the only way in which to account for the presence of the permanent mouth furrows.

Comparisons of the young with those of *Gervilii* and *Brongniartii*, seem to indicate a very close affinity; but this evidence, and the adult characteristics appear to indicate a close relationship also to *microstomum.* find also in my notes that one specimen in D'Orbigny's collection had young resembling *Humphriesianum.* The only safe conclusion, therefore, is to provisionally trace it back to *Brocchii* as a direct derivative.

There is one significant fact not mentioned by D'Orbigny, which his specimens show. The abdomen is furrowed in many specimens. The mouths, also, of the originals are more compressed than in his figures 2, 4, 8, pl. 141. There is one specimen of this species in the collection at Munich having a most remarkable resemblance to *Amm. globosus* in the form and also in the outlines of the mouth.

TENTH SERIES.

Stephanoceras Braikenridgii.

Amm. Braikenridgii Sow., Min. Conch., pl. 184.

Amm. contractus Sow (pars), Min. Conch., pl. 500.

Amm. Braikenridgii D'Orb., Terr. Jurass., pl. 135.

This species has given great trouble to all who have undertaken to study the question of its affinity. Quenstedt long since pointed our its close relationship to *Humphriesianus nodosus.* The large ear-like expansions, however, which it possesses at an early age, cast more or less doubt upon this apparently unavoidable conclusion. The large and quite complete suite of specimens in this Museum and at Bristol leave, however, but slight room for doubt that Quenstedt was right.

The young in nearly all cases are strictly similar to the young of *subcoronatum,* however much the adults may vary in form and characteristics; a small number of them, however, especially from Dundry, England, are very similar to *contractum* from the same locality though they upon close examination exhibit differences in the thinner forms and slower increase of the shell by growth and in the coarser ribs.

Oppel identifies *Brocchii* with *contractum,* and this appears to be true in most collections, but an examination of the young of such specimens from Dundry shows at once that they in part are true *Brocchii,* and part belong to this species. The *contractum* described and figured by Sowerby I have seen, but my notes thereupon are not satisfactory. Whether any species is really intermediate between this and the *subcoronatum* in all its characteristics I cannot say, but any one who will consult the descriptions of *Amm. fuscus* by Quenstedt, Der Jura, p. 475, which may or may not have the peculiar broad lateral ear-like expansion of the mouth edge, according to the variety to which the shell belongs, will see that this is a probable inference. These observations can be readily confirmed in any good collection of *Amm. fuscus*, and show that the presence and absence of the ear-like expansions may take place in forms as closely allied as the two alluded to above. Intermediate forms with the lappets as a variable characteristic, or as a characteristic of the adult stage of growth alone, ought to be eventually found in those varieties which approximate closely to *subcoronatum*, if this is a correct view.

Quenstedt alludes to large forms which have no lappets, and these may have some bearing on the question, but I refrain from expressing an opinion since, unfortunately, I have not seen such examples. I would, however, mention that there are certain forms which about evenly divide the characteristics of the two species, but the absence of the mouth makes the reference of these to either *Braikenridgii* or *subcoronatum* doubtful. Some of the latter have the young until a late period, precisely similar to the flat abdomened form of *subcoronatum* with the similar ribs and tubercles; and this is the general character of the development in the larger specimens, but in smaller specimens, especially the English forms, a more contractum-like form becomes apparent at an early stage, and the development approximates to what it eventually becomes in *Sauzei*.[1]

Stephanoceras linguiferum.

Amm. linguiferus D'Orb., Terr. Jurass., pl. 136.

The varieties of this form fade into those of *Braikenridgii* by insensible degrees, though the extreme forms differ in the larger comparative size of the whorls, the amount of envelopment, which is greater than in *Braikenridgii*, the peculiar bent aspect of the lateral ribs and the more ornate aspect of the shell, due to this arrangement of the ribs, the fine abdominal ribs and the prominent tubercles. The increase in the size of the shell is constant in this, and also in *Braikenridgii*, there being no regular contractions in the size of the whorls due to growth, as in *Sauzei*. *Amm. Torricelli* (sp. Oppel) is a form of this species, as it appears in Mœsch's collection at Zürich and in the Paleontological collection at the Munich Museum. *Amm. Keppleri* Oppel ought also, according to my views, to be included under this name.

[1] *Subcoronatum* is merely an intermediate form between this species and the true *nodosum*, and therefore I quote from Quenstedt's views as directly confirmatory of the above.

Stephanoceras Sauzei.

Amm. Sauzei D'Orb., Terr. Jurass., pl. 139.

The thick tumid aspect of the young of this shell has caused me repeatedly to place it in the same series with *Gervilii*, but a renewed inspection has just as often brought me back to the same conclusion that this was due entirely to the purely coronatum-like form of the young, which at a very early stage is not round and smooth as in *Gervilii*, but more like *subcoronatum* or *Blagdeni*. This remarkable difference in the development confirms the contrast of structure between the mouth of the shell with its ear-like lappets, and the plain Humphriesianus-like outline of that of *Gervilii*. The form also differs somewhat. The living chamber near the mouth becomes depressed from above, as in *Braikenridgii*, instead of contracting laterally, as in *Gervilii*, and all allied forms. There are several varieties, but the principal are those with open umbilici, in which the young retain the true *coronatum* form until a late stage of growth. These always seem to have prominent tubercles at an early age, and are altogether more similar to *Braikenridgii* than those with narrower umbilici. The last are more involute, have the tubercles later developed, the ribs finer, and the young in form and markings so similar to the young and adults of *Gervilii* or *Brongniartii* that they are often confounded.

This is one of the few instances in which the history of the development and adult characteristics appears to be at variance with the geological record. *Braikenridgii* has only been found in the Humphriesianus-bed, whereas *Sauzei* is habitually found in the lower part of the Humphriesianus-bed, the "Sowerbyii-bed." This, however, is only a slight discrepancy which may arise from false identifications, and I have therefore ventured to disregard it in the genealogical table.

DOUBTFUL SERIES.

Stephanoceras refractum.

Naut. refractus Rein., Naut. et Argo, figs. 27–30.

Amm. refractus D'Orb., Terr. Jurass., pl. 173.

" " Quenst., Der Jura., p. 524, pl. 69.

This bent and distorted form has young which can be compared only with the young of this series, and it is possible that a sufficient number of specimens would enable an observer to trace it directly to some one form. There is, perhaps, more resemblance to *microstomum* in the young of the specimens which I have examined, but the large ear-like lappets are very dissimilar characteristics. The abdominal channels are present in some specimens of *microstomum*, and in some of the other species of the group as a rare variation, so that their prominence in this species can not be considered as absolutely conclusive against this view of the affinities.

I have failed entirely in finding any species of the *Parkinsoni* group to which the young might be compared. The development of the ears seem to decide in favor of its association with the *Sauzei* group, but the large rostrum between them is an entirely new organ, not shown in either *Braikenridgii*, *Sauzei* or *linguiferum*. In fact it has the most curious and unaccountable mingling of the characteristics of several groups, with certain prominent characteristics entirely peculiar to itself. Quenstedt quotes one form as found in the Parkinsoni-bed, and speaks of this in "Die Cephalopoden" as an undoubted "crippled" *Parkinsoni*. I have failed to recognize this fact in his collection. My notes give me no hints on the subject, and I may have omitted seeing the specimens he refers to.

Whether to connect this species with the *Microstoma impressa* Quenst. of the White Jura or not, I cannot say. There appears to be a close affinity between the development of the young, and the abdominal furrow is well developed; but on the other hand such resemblances might occur in simply representative species of distinct genetic series. The *Amm. Schaphitoides Coynarti* of the Oxford, fine specimens of which exist in the Prof. Mœsch's collection at Zurich, has an irregular form and the same furrow in the abdomen of the living chamber, but the mouth was not shown. *Amm. Chapuisi* and *Collinii* Oppel of the White Jura of the same collection, are evidently closely allied to *Amm. scaphitoides*, but like that species resemble *refractum* only very remotely, and I think will be traced eventually to some form in the White Jura.

Section of Botany. June 12, 1876.

Mr. W. P. Wilson in the chair. Twenty-seven persons present.

Mr. Charles Wright made some remarks on the characters of *Rubus villosus* and *canadensis*, calling attention to an intermediate variety from a locality in the Connecticut Valley, which is often submerged for long periods. He suggested that the seeds might furnish good specific characters in these cases. Mr. Wright also showed a specimen of *Carex*, probably *C. granularis*, which had remarkably long flower stalks of last years' growth.

Mr. G. Dimmock showed specimens of *Syritta pipiens*, and a butterfly, *Chrysophanus americana*, which he had found engaged in the cross fertilization of the dandelion. He had also noticed the common yellow and the cabbage butterflies on these flowers.

Mr. E. H. Hitchings exhibited a specimen of *Liparis lillifolia* in flower, a plant he thought as yet unrecorded from our vicinity.

Mr. Wilson remarked that Mr. B. P. Mann had found that *Rhodora* exhibits a tendency to the separation of the sexes, and hoped that the members of the Section would turn their attention to the discovery of new cases of this kind.

Section of Botany. June 19, 1876.

Dr. J. C. White in the chair. Twenty-one persons present.

Dr. W. G. Farlow showed specimens of Wild Cherry (*Prunus serotina*), with the stamens, petals, and ovary abnormally swollen.

This disease is the same as is known in Germany as plum pockets. It is a fungus *Ascomycetes* in its simplest form, named *Exoascus pruni*. Specimens of May Apple, similarly distorted, were shown. These swellings have only recently been shown to be due to fungi, having been supposed to be caused by insects.

In answer to a question concerning division of sexes, *Allium trococcum* was shown by Mr. G. F. Waters, who also stated that the female plants disappear in an asparagus bed.

A seedling grape (the Iona variety) was shown, where the plant had only pistillate flowers. In all these the sexes were on different plants.

Mr. W. P. Wilson read a letter addressed to Dr. Gray, from Prof. De Caisne of Paris, concerning *Epigæa repens* L. From specimens sent him he had determined a new species based on the comparatively large spreading lobes of the stigma. Flowers with such a stigma are fertile, but contain imperfectly formed pollen, or often none. Dr. Gray thinks this plant may possibly be progressing towards a diœcious condition.

Mr. Charles Wright spoke of the unfitness of the name of *Diervilla trifida*, which almost never has a trifid peduncle.

June 21, 1876.

Vice-President, Mr. S. H. Scudder, in the chair. Eleven persons present.

The following paper was read: —

Reptiles and Batrachians collected by Allen Lesley, Esq., on the Isthmus of Panama. By S. W. Garman.

The collection which serves as the basis for the following notes was made at a point about midway from Aspinwall to Panama, on the Chagres River. Though small it was well selected, and, what was especially satisfactory, it was unusually well preserved. Whenever practicable these specimens have been compared with others from the north or south, with the view of determining as much as possible of the extent of territory occupied by each species, and of the amount of variation obtaining among its representatives in different parts of the habitat. Consequently such remarks as are placed under several names of the list are results of a somewhat general study of the species. The material for such study, in the Musseum of Comparative Zoology, at Cambridge, is provided by the collections of Messrs. Agassiz, Albuquerque, Bourget, Linden, Maack, Sarkady, Sceva, Steindachner, the Thayer and Hassler Expeditions, and others, which contain representatives of local faunæ from many points between Mexico and Patagonia inclusive.

In the greater portion of tropical America the diversity of surface is not excessive, and since in the torrid zone the conditions of light and heat are least variable, we are naturally led to expect to find the species, compared with those of other latitudes, more widely distributed and at the same time less affected by variations in color or covering. The specimens before me accord well with this idea. In a comprehensive view of the South American Reptilia and Batrachia the species seem to fall naturally into four groups, representing as many more or less distinct faunal areas. As indicated by these groups we have a northern section, comprising all of northern South America, including Ecuador and Brazil — except the southeastern part — and extending over the Isthmus to the table land of Mexico; an eastern, containing that portion of Brazil included in Pernambuco and the provinces to the southward; a southern, made up of the pampas of the Argentine Confederation and Patagonia; and a western, which includes the plateaus and western slopes of the Andes in Chili, Bolivia and Peru. For convenience they may be designated as the *torrid*, *eastern*, *pampan* and *andean* sections.

Physical features that are hardly noticed in the movements of the species of one class of animals, assume very imposing proportions in connection with those of species of another. An elevation or an arid region over which the majority of species of the first passes freely offers an insurmountable obstacle to those of the second.

In a general way, speaking of Reptiles and Batrachians, the geographical conformations present little or no hindrance to the spread of a species between the Amazon-Orinoco basin and the Isthmus or western Ecuador, while the existence of a tolerably effective separation between the Amazon basin and the eastern section, needs no plainer demonstration than that afforded by the difference of their respective faunæ. As for the Surinam region, I know of no really distinct form belonging there. Pipa, or as it is commonly called, the Surinam Toad, is represented in the Museum from the Madeira, and Spix is authority for the statement that it occurs in the waters near Bahia. Southward from the Isthmus, on the west coast, a limit is reached in the sterility of northwest Peru. The separation of the North American species from those of the south is effected by the table land of Mexico; it is not absolute, however, a few species being common to both sides.

A consequence of the similarity of climatic conditions in all its parts and of the absence of obstructions is, that species have been able to spread themselves over enormous extents of territory in the torrid region, affected little by variation.

Some idea of the condition of these orders in this and the eastern districts may be obtained from the following instances, in which each is represented by one of its most widely distributed and also by one of its more restricted species.

One of the most common reptiles in the torrid and eastern sections is *Iguana tuberculata* Laur. Its range extends from Mexico to southern Brazil, and — if we accept as valid the closely allied species *I. rhinolopha* Wiegm., which occurs with it in Central America — it nowhere, according to collections from upwards of twenty localities, acquires differences enough to characterize a variety or to enable the student, even approximately, to determine the locality from the specimen.

We are able to indicate from the specimens a range for *Teius nigropunctatus* Spix over the torrid section from Cape St. Roque and Villa Bella to the Darien extremity of the Isthmus, not including Ecuador. The variations shown by the most distant localities are comparatively slight. In squamation they are similar throughout. Specimens from the Gulf of Darien have the colors less mixed, the yellow brighter and the brown darker; from Ceará have less yellow, more olive, and greater confusion of markings; and from Villa Bella have lighter colors generally, and a reddish tint — as figured by Spix. In passing from one locality to another the changes are so gradual that the separation of the species into groups of any value to the student is next to impossible. In the eastern section this species is displaced by *Teius teguixin* Linné.

Among batrachians, *Cystignathus ocellatus* (L.) Tsch. has a range which covers and exceeds that of Iguana. Its representatives in the eastern section form a variety marked by colors and a somewhat larger size.

Bufo agua Latr. inhabits the entire torrid section; on the head waters of the Tocantins a variety is characterized by smaller size and colors; in the eastern section it is displaced by another species, *B. ictericus* Spix.

Other instances illustrating the community of species between the Isthmus and the Amazon basin are enumerated below. It is not only the larger and stronger that are common; the natural barriers seem to have proved equally ineffectual against some of the species most poorly furnished with means of locomotion. As it is, the respects in which the fauna of the Isthmus differs are so few, comparatively, as to render very questionable any attempt to treat it as if it were distinct from that of the Amazon-Orinoco region. The study of its Reptiles and Batrachians can only be successfully pursued with continual reference to, and comparison with, those from the south and east.

Of nineteen species in Mr. Lesley's collection, fourteen are known to be common to the eastern portion of the torrid section, and subsequent investigations will undoubtedly increase this number.

REPTILIA.

Emys venusta Gray.

Common. Represented in the collection by very young only.

Ameiva præsignis B. et G.

Three specimens. Longitudinal bands very distinct. Preanal plates unlike. Several cephalic plates subdivided in one example. Femoral pores 15, 16, 17. Compared with specimens of *A. surinamensis* from Tabatinga, on the upper Amazon, these are stouter and darker in color — more olive and brown. The median dorsal band is not present on the southern specimens, and the upper bands of the sides disappear about the middle of the length of the body; the spots are much smaller and more separated. Mr. Lesley's specimens, however, do not agree among themselves in regard to the length and distinctness of the dorsal band, and in younger examples it is probably indistinct or absent.

From the close correspondence in details of squamation and coloration, it is not at all unlikely that intermediate forms will be found to connect the two as varieties under one species.

Euprepes bistriatus (Spix) Wagler.

Spots of brown in the bronze of the posterior half of the back are plentiful. The upper white band on the flank becomes indistinct in the larger examples; that below the brown retains its brightness. Belly bluish white. A tinge of blue in the bronze on the back. Young specimens have fewer spots, less blue on belly and back, and the upper line on the flank is more distinct.

Iguana tuberculata Laur.

The green on the backs of the young is so dark that the bands are invisible, those on the tail are indistinct. Half-grown specimens show all the marks distinctly. All have from five to seven bands of black on the throat pouch; these are broken up or lost in the old. On small specimens the occiput is rounded; a few scales on each side enlarge and thicken so as to form angles as the animal approaches maturity. Adults have more of yellow or gamboge; frequently they are freckled with scales of yellow. The scales of the crest are very small in the young. This species retains its integrity from Acapulco to Rio Janeiro; the variations to be noted in the whole range are slight compared with those of individuals from a single locality. A collection of twenty specimens from Santarem includes some mottled with yellow, as are very large ones from Panama and Turbo, others of the colors of Spix's figure of *squamosa*, others of those of his *viridis*, others having the greyish blue of *cærulea*, and yet others fairly represented by his figures of *emarginata* and *lophyroides*.

Individuals vary in respect to the number of tubercles on the neck, the amount of convexity and number of prefrontal scales, and the number and arrangement of the row of large scales on the side of the head below the ear.

Basiliscus mitratus Daud.

Specimens from various places between Mexico and the east side of the Gulf of Darien. Males from the northern localities have the brown markings and the longitudinal lines more distinct; the females are more indistinctly marked, and usually more of a dingy rusty brown. Southern specimens are less bright, and the transverse bands are hardly to be observed. In the same locality there is much difference noticeable in specimens of various ages in respect to shape and size of helmet and the scales covering it, also in regard to the height, number of rays, and the scaling in the crests. The rays of the dorsal and caudal crests increase in length and number with age; a young adult male possesses from one to several less in number than an old one. The helmets and the scales on their sides increase in size with age; with little or no increase in number the scales expand as the crest enlarges, so that the old male has more large scales on the helmet than the young. Females do not develop the helmet. When broken the tail is reproduced. The animal which served as the type of *Corytheolus vittatus* Kaup. was no doubt a young male of this species, taken at the time the helmet began to enlarge, before much change had occurred in the crests. *Corythophanes cristatus* (Merr.) Boie differs from the species of *Basiliscus* in the skull, in a crest along the back of the entire neck, a small circular nasal plate which does not rest upon the first labial, and a flat head covered with flat scales, which are similar over the entire surface. *C. cris-*

tatus was well placed by Dumeril and Bibron with *C. chamæleopsis* D. and B. (if named more in accordance with priority, *C. Hernandezii* Gray). It is possible the author of Art. IV, in Jour. Ac. Nat. Sc. Phil., 1875, p. 125, intended to refer *Corytheolus* instead of *Corythophanes* to Basiliscus.

Anolis Schiedii Wiegm.

An adult female with dorsal and lateral bands distinct; a brown spot on each side of the back of the neck; the upper surface of the head anterior to and above the eyes dark. A male with the goitre well developed has distinct lateral bands, a light band along the dorsum, and darker brown on the occiput. A second female is much darker, and has but a faint indication of the dorsal line.

Stenorhina Degenhardtii (Berth.) Jan.

a. Light brownish olive. Subabdominals 173 + 1 pairs; subcaudals 40 pairs.

b. Olive brown, much darker than the preceding. In the former the frontal is in contact with the second labial; in this the postnasal and anteorbital meet between labial and frontal. Anterior edges of dorsals and abdominals in each specimen darker colored. Abdominals 166 + 1 pairs; subcaudals 35 pairs.

Liophis reginæ (L.) Wagl.

In different specimens there is considerable variation in the number of white edged scales; on some they are so numerous as to form transverse bands. Those in this collection are probably to be placed in the variety *albiventris* Jan. As the smaller number of scuta seems quite constant, it is likely that this will prove a more stable foundation for a variety than the coloration, which varies so much in individuals. Of the five examples from this locality, the abdominals and subcaudals number as follows:

1.	Abdominals	135,	subcaudals	61	pairs.
2.	"	138,	"	62	"
3.	"	141,	"	61	"
4.	"	140,	"	60	"
5.	"	135,	"	63	"

Xenodon Bertholdi Jan.

Three specimens with three postorbitals on each side, one with two. Dorsal rows 19.

a. Bands on head very distinct; belly with nebulous blotches of brown. Ventral scuta 149 + 1 + 44 pairs.

b. Interiors of the crossbands on the body darker than on the preceding. Bands of forehead obsolete. Belly with small, ill-defined, scattered dots. Markings darker. Ventrals 148 + 1 + 46 pairs.

c. Back lighter colored; marks of head and body distinct; band on forehead; abdomen much flecked and spotted with brown. Ventrals 149 + 1 + 42 pairs.

d. Smallest specimen. Bands on head and body most distinct. The bands from the flanks, becoming more faint, extend across the abdomen. Ventrals 150 + 1 + 42 pairs.

The smaller of these have more of dark on the lower surface, and the markings in general more distinct. Though the marks do not become indistinct, there is a fading out of the central portions of the bands which eventually gives the appearance of twice the number.

Herpetodryas carinatus (L.) Schleg.

Differing very little, if at all, from specimens from the Ucayale River. The two keels and the light colored dorsal band are present. Ventral scuta 158 + 2; subcaudals 126 pairs.

Oxyrhopus petolarius (L.) D. and B.

Var. *Sebæ* D. and B.

One example is of medium size, the other very small. The first is marked by twenty-four half rings of black between the head and the vent; and the hinder abdominal scuta are sprinkled with brown. Subabdominals 205 + 1. Twenty-six half-rings occupy the body of the smaller specimen; among these there is rather more irregularity than in those of the first. Two upper labials are united on one side of the head. Subabdominals 223 + 1; subcaudals 85 pairs. On the tails the black rings are complete. The half-rings are wider than the red spaces. Both specimens are irregular in the markings of the middle of the body.

Eteirodipsas annulata (L.) Jan.

a. A single anteorbital on one side. Ground color a reddish brown; lateral series of spots reduced in size. Subabdominals 173 + 1 pairs; subcaudals 74 pairs.

b. Ground color greyish brown; spots similar to those of preceding. Subabdominals 170 + 1 pairs; subcaudals 78 pairs.

Elaps semipartitus D. and B.

This specimen agrees well with the figure and description given by Prof. Jan of *E. multifasciatus.* There are fifty-seven black rings — two of them on the tail; on the upper side of the tail, behind the last ring, there is a rounded spot and the tip is black; the muzzle is black; the throat spotted. A single irregular ring is seen on the middle of the body. Between the inframaxillaries and the anterior abdominals there are five series of small scales. Abdominals 287; subcaudals 25 pairs.

Elaps corallinus (L.) Neuw.

Large and small, of the variety *circinalis* D. and B. Tips of tails and muzzles black —color not extending on the inframaxillaries. Ends of the scales black in the red rings, not in the yellow. Adult with sixteen black rings on the body, three on the tail; young with eighteen on body, and three on tail. Between inframaxillaries and anterior ventrals there are two small scales on the throat of the larger, three on that of the smaller. Abdominals and subcaudals of the former 221 + 39 pairs; of the latter 223 + 39 pairs.

The transition from *corallinus* through *circinalis* and *Fitzingeri* to *E. fulvius* is so gradual as to make it necessary to consider them as varieties of a single species. If so considered, the range of this species from Virginia to Brazil gives it a greater distribution than that of any other American reptile.

BATRACHIA.

Cystignathus ocellatus (L.) Tsch.

In addition to the specimens belonging to this collection there are at hand others from various points between Central America and Uruguay. Those from the Isthmus are more olive, those from the lower Amazon more brown, and those from the southern localities and Villa Bella more grey. The disposition of the spots is the same throughout, but the amount of variation in shapes is infinite in the same vicinage. Young examples are light in color and slender in form; the head is narrow, the snout pointed, and there are four or more longitudinal folds in the skin of the body; later in life the ground color darkens, some of the folds disappear, the head widens and thickens at the shoulders, the vomerine teeth approach more closely and the figure becomes stout and heavy. Just above and behind the upper arm in large specimens traces of the glandular growth may be discovered; from this it gradually extends over the side. On dissecting, the structure is found to be made up of numerous round-ended piles or cylinders set up on end close together upon the skin immediately within the epiderm. It does not appear until the adult stage is reached, and in all probability is superinduced by the excitement attendant upon coupling. In the season males are common in which the anterior half of the body has undergone the transformation, the posterior remaining as in the young until included in the changed condition more gradually. Only the very large discover the flank entirely covered by the gland. The differences between the lighter colored from farther south and those of *C. labyrynthicus* (Spix) D. and B. from Ceará are scarcely specific. The presence of the glandular structure on the flank in the older specimens of *C. ocellatus* necessitates the return to this genus of the species withdrawn to form the genus Pleurodema of Tschudi.

Bufo agua Latr.

Adult females and young of both sexes similarly marked with spots and having the warts smooth to the touch. Adult males—differing in this regard from what obtains amongst the birds, where the females are least marked—are more modestly colored, uniform olive or brown; they are smaller, and the warts are usually rough with small spines. The numerous specimens in the Museum have been gathered from upwards of twenty widely separated localities, and represent an area including the entire Amazon basin, extending eastward to Ceará, southward to Goyaz and Villa Bella, and northward and westward to Acapulco, Mexico. The rhomboidal shape and the size of the paratoids serve to distinguish the species wherever found. Occasional large specimens have these glands somewhat rounded or blunt posteriorly, but as this is not common to the young it is to be regarded simply as the result of an unusual amount of development. Considering the extensive distribution of this animal and its means of locomotion, the amount of variation to be noticed in the most distant localities is surprisingly small. The plan of coloration is quite the same throughout the entire region. A pair of dark spots between the hinder halves of the paratoids, and one or more pairs of smaller ones farther back, are to be discovered in all young examples. Acapulco and isthmus specimens are more olive; those from Ceará are more brown and the spots more spreading. On those from a small pond on one of the Pearl Islands, in the Gulf of Panama, the tendency toward uniform olive is so great as to render the spots almost obsolete. On the uplands of Minas Geraes and the head waters of the Tocantins the species attains but little more than half the usual size, and is lighter colored. The spots on the back are ringed with white, and the creature is much more warty. When the epiderm is removed, the whole upper surface is black spotted, or reticulated with white, a narrow white line extends along the back, and the lower surface is punctate with black. Our specimens possess rudimentary cutaneous expansions; this is the only respect in which they differ from the description of *B. ocellatus* Gthr. Since the habits, shapes of paratoids and positions of spots and warts are similar, and the transition from the large to the small so gradual, it is not possible to consider them as representing more than a variety.

The species *B. ictericus* Spix cannot be retained as synonymous. A difference by which it can be distinguished most readily is that of the shape of the paratoids. In this the glands are regular elongate oval, and twice as long as wide; in *B. agua* Latr. they are rhomboidal, nearly as broad as long, and usually pointed at the hinder angle. Specimens of less than an inch in length show these differences distinctly.

Other species found in various collections examined are distributed as follows:

B. granulosus Spix. Valley of the Amazon.
B. ornatus Spix. Bahia to Rio Janeiro.
B. ictericus Spix. Espiritu Santo and Rio Janeiro.
B. globulosus Spix. (description appended). Rio Grande do Sul.
B. D'Orbignyi D. and B. Argentine Confederation.
B. chilensis D. and B. Peru, Bolivia and Chili.
B. valliceps Wiegm. Mexico and Texas.
B. lentiginosus Holbr. Mexico and United States. Several varieties.

Hyla Baudinii D. and B.

a. A specimen on which the color of the back is a clouded dark brown. On the legs the brown is broken with white, and behind the thighs there are two large white spots. The brown becomes darker on the flanks near the borders which are quite irregular. Spots of brown are scattered in the white of the lower portions of the sides and the under surfaces of the legs.

b. A half-grown specimen of a light brownish red, with reddish brown in a band from the nostril through the eye to the middle of the flank, in bands on the arms and legs, and in a few spots on the dorsum and sides of the legs. The pair of spots on the thigh is indicated by the border of dark, which is all that appears.

Hyla maxima (Laur.) Günth.

The medium sized are more uniform in coloration than the larger and the small; the latter have the markings in most distinct outline. All possess the black line on the dorsum and bands across the flanks.

The younger ones bear an ×-shaped mark across the shoulders. Seven specimens in Mr. Lesley's collection.

Coecilia gracilis Shaw.

On four perfect specimens the rings from head to anus number respectively 178, 184, 190 and 186. The crowded rings of the tail vary from fourteen to thirty, larger examples having more than small. Under the lens the skin appears reticulated by narrow brown lines forming small hexagons. Small specimens are light chestnut olive; the large become dark olive or brown.

APPENDIX.

Description of **Bufo globulosus** Spix.

Body medium. Head triangular, with sides nearly perpendicular. Bony ridges on the crown strong, but not high, and not diverging widely on the occiput; branches extend to the paratoids, in front of each eye, and in front of the tympanum. Snout blunt, not protruding. Tongue widening a little backward. Tympanum medium, distinct, higher than long, height equal to half the length of the orbit. Paratoids moderate, narrow, as long as the head, supplemented by a row of warts on the flanks. When viewed from above they appear exceedingly narrow and taper gradually. Warts flattened, smooth on females, rougher on males. Fingers free, first and third about equal, second longer, equaling the fourth. Tubercle at base of finger half as large as that in centre of palm. Tubercles on the foot equal, inner shovel-shaped. Leg to extremities of toes as long as the body. Toes half webbed. Tarsus with a cutaneous fold. Back brown — light to dark —with broad rounded spots or bands of white; on the hinder two-thirds of the body the white spots — more or less irregular and confluent into bands — are disposed on each side of a broad band of brown along the dorsum; in front of this a white band reaches the head. Some are more white than brown, others are of a light reddish brown, nearly uniform. Thighs, legs and flanks banded or spotted with brown and white. Below yellowish white, smooth as if glazed anteriorly, granulated and more yellow under the thighs. The brown spot covering the anus is surrounded by white. Small specimens are whiter. Length of body of largest four inches. Five specimens from Rio Grande do Sul. Differs from *B. ornatus* Spix in shape of head, low orbital ridges, coloration and shape of glands;

from *agua* and *ictericus* in size, shape and size of head and glands, and coloration; and from *D'Orbignyi* in color, glands and orbital ridges.

From near Goyaz, on the highlands of east Brazil, we have two specimens of a toad agreeing with this in size and outline which has been named *B. rufus* on account of the red color on the hinder half of the body. It differs principally in the small points or granulations which cover the ventral surface, in the paratoids which taper less and are more widened posteriorly, and in the coloration, which is a light rusty brown with indistinct spots of darker on the back, narrow bands and spots of brown on the thighs, and narrow transverse bands of the same on the legs, from the knee to the toes, and with the hinder parts, in life, tinted with red. The differences are certainly sufficient to mark these specimens as belonging to a distinct variety, and most probably other collections from this region will establish them as of specific value.

Section of Botany. June 26, 1876.

Dr. W. G. Farlow in the chair. Nineteen persons present.

Mr. Chas. Wright said that he had paid some attention recently to *Amelanchier canadensis*, but had been unable to find any satisfactory distinction between the varieties, *oblongifolia* and *botryapium*; the former, however, seems to bloom later and ripen earlier than the latter.

July 5, 1876.

The President, Mr. T. T. Bouvé, in the chair. Fifteen members present.

Prof. E. Ray Lankester, of London, Lt. G. M. Wheeler, U. S. A., and Maj. J. W. Powell, of Washington, were elected Corresponding Members.

Messrs. Woodbridge H. Birchmore, W. O. Crosby, Thos. J. Emery, J. W. Fewkes, Bernard Whitman Flagg, Edw. G.

Gardiner, D. S. Greenough, Jr., Byron D. Halsted, Edward M. Hartwell, Wm. J. Knowlton, Prof. R. Pumpelly, Rev. Edw. Stone, William Powell Wilson, were elected Resident Members.

The following paper was presented: —

Notes on Noctuæ from Florida. By Aug. R. Grote.

The following species are mentioned as being of interest among a number of Noctuæ collected by Mr. Roland Thaxter of Newtonville, Mass., during a short residence in Florida the past winter.

Bryophila percara Morr., Proc. Bost. Soc. N. Hist., XVII, 213.

A single fresh male expanding 20 mill. The specimen agrees with the description above cited, in the shallow indentation below the apices on external margin of fore wings, and, generally, in ornamentation. The color is, however, not "ochreous," but pale olive green, a little brighter than that of *Microcœlia vinnula* Grote. There is a "large, triangular, blackish spot resting on the (?) margin"; this spot is situate beyond the t. p. line, and rests with its base on the *internal* margin. Tallahasee, Fla., April 10, No. 3174.

Perigea Icole sp. nov.

♂. The color is that of *xanthioides*, but more intense, while it is one-fourth larger than that common species. The specimen is in fine condition, showing the tuft behind the collar. The color of the primaries is intense brownish red, with the median lines paler, somewhat orange, and with the veins marked with black. The median lines are geminate, with included paler shading, the component lines separate, indistinct, not black nor jagged as in *xanthioides*, but nearly even, especially the t. p. line, which has a slightly rounded sweep opposite the cell. Orbicular concolorous; the constricted reniform spot is marked by a large pure white spot on the median vein, and there are a few white scales on its indistinct blackish marginal ring. Subterminal line indistinct; fringes darker than the wing. Hind wings pale, silky, with smoky marginal shades deepening outwardly, and pale fringes. Beneath both wings whitish inferiorly, powdered with red superiorly; fore wings shaded with black on the disc, and with two indistinct sinuate external shaded lines. Thorax and head like fore wings. Expanse 33 mill. Appalachicola, No. 2709.

This species is of the size of *Perigea luxa* Grote, a specimen of which was taken by Mr. Thaxter in the same locality.

Eriopus granitosa Guen., Noct. II, 295.

Appalachicola, Dr. Chapman. This is the first specimen I have ever seen of this beautiful species, which has not been previously alluded to by American writers.

Scolecocampa liburna Grote, Bull. Buff. Soc. Nat. Sci., II, 20.

Appalachicola, Mr. Thaxter. Southern specimens of this species show a red-brown shading along internal margin of primaries, and on the reniform spot, exaggeratedly given in Geyer's figure.

Heliophila pilipalpis sp. nov.

A male specimen having the facies and ornamentation of *pseudargyria* Guen., but without the exaggerated tufting of abdomen and tibiæ. Stout, with hairy eyes and smooth front, and with a curious fan-shaped tuft of spreading hair arising from the upper surface of the second joint of the unusually prominent palpi. Head, thorax and anterior wings concolorous, fawn gray, like pale specimens of its ally. Fore wings sparsely speckled with black. Median lines fragmentary, composed of black marks; t. a. line outwardly oblique, subobsolete. Cell shaded with black. Orbicular spot wanting. Reniform narrow, pale, S-shaped, intersecting inferiorly the black discal shade. T. p. line formed of double dots, connected as in *pseudargyria*, but the line is more oblique and inwardly removed. Fringes pinkish, as is the internal margin, the latter showing an accumulation of the black irrorations. Hind wings whitish, with a smoky clouding outwardly above vein 2. Beneath whitish, without markings, with the fringes on fore wings pink, and the black transverse line visible on costa. Expanse 43 mill. Appalachicola, Mr. Thaxter, No. 3160.

Lygranthœcia scissa sp. nov.

A moderately sized species between *lynx* and *arcifera*, remarkable for the angulation of the exterior black band of primaries opposite the cell. Fore wings triangulate, without defined lines, brownish black, median space more rusty and paler, showing the large black reniform spot; median lines obscure, indicated by difference of shading. Hind wings with the central portion clear dark yellow, showing a large black discal spot. Marginal black band broad, sharply defined, angulated opposite the cell; base and internal margin black. Beneath the median fields of both wings yellow, secondaries darkest, defined by black discal spots; basal and terminal fields blackish; costal region of secondaries red, as are more slightly the apices of primaries. Thorax red-brown; abdomen black, with narrow yellow segmental fringes and yellow anal hairs. Expanse 18 mill. Appalachicola, Mr. Thaxter, No. 2782.

The colors of this species are vivid, and the insect presents a casual resemblance to the yellow winged species of Annaphila.

Mr. Thaxter has collected also of the present group the species *L. tuberculum*, *Prothymia rosalba*, *Spragueia fasciatella* and *apicella*, *Thalpochares patruelis* (*Tarache patruelis* Grote).

Ophideres materna (Linn.).

A single specimen taken by Mr. Thaxter at Appalachicola, March 24. The specimen agrees with Drury's figure (II, Plate XIII, fig. 4), as with Guenée's description (III, 113). The discovery of this species in Florida is attended with unusual interest. The species is common in Java and the East Indies, according to authors. M. Guenée records an individual reared by Bescke at New Freiburg, Brazil, without mention of the food-plant of the larva. Recent investigations by Künckel (re-published in the "Popular Science Monthly for June, 1876) have brought to light the peculiar structure of the terebrant trunk in this genus, so rigid and peculiarly formed at the extremity as to be able to pierce the rinds of oranges and suck the juice. In the present specimen, so far as I can perceive under the microscope without detaching the trunk, the end of the maxillæ exhibits a conformation like that figured by Künckel of *Ophideres fullonica*. M. Guenée conjectures that the species has been accidentally introduced into Brazil by commerce, and adds of the specimen examined by him received from Bescke: C'est la première qui, à ma connaissance, ait été trouvée en Amérique. The orange, upon which the moth of *Ophideres* is stated to feed, is Asiatic in origin, and it would be of interest to ascertain that it has been followed to America by its parasitic insects. The attention of orange planters in Florida is drawn to these statements in the hope that the complete history of the species be discovered. It is probable that the appearance of the fruit would be injured by the attacks of *Ophideres*, and if the insect multiplies in Florida it will not long escape more general notice.

Phurys glans sp. nov.

At first sight recalling *Celiptera frustulum*, but differing by the shorter third palpal article, and agreeing with *vinculum* and *lima* in this respect. Of the same uniform gray, with all the markings illegible except a rather narrow deep brown stripe, which runs obliquely and nearly evenly from apices to internal margin at outer third.

Inwardly this stripe is lined with ochreous. Faint terminal dots obsoletely connected by a festooned thread-line. Hind wings grayish fuscous, without lines. Beneath only the terminal dots are noticeable. Expanse 35 mil. Appalachicola, Mr. Thaxter, No. 3129.

The present collection is rich in species of *Poaphila.* I have identified *erasa*, *herbicola*, and *obsoleta* Grote, the latter described by Guenée as a variety of *quadri-filaris*, from which it seems to be distinct. With some hesitation I have affixed the names *deleta* Guen., and *sylvarum* Guen., to two species which do not quite agree with the descriptions in the Species Géneral under these names.

For our existing knowledge of the Noctuæ we are largely indebted to the patient observations of Mr. Roland Thaxter; and owing to his care in preparing material for the cabinet the work of determination is made easy.

ERRATA.

Page 162, last line but one, for *Tinunculus* read *Tinnunculus.*

Page 163, ninth line, for *clilophus* read *dilophus.*

Page 331, fifth line from the bottom, insert between the words "the" and "heart" these words—"nidamental glands above the"

Page 401, last line but one, for *trococcum* read *tricoccum.*

INDEX TO VOL. XVIII.

The names of genera and species described as new are italicized.