PROCEEDINGS

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CONTENTS OF VOL. XIX.

PROCEEDINGS

OF THE

BOSTON SOCIETY OF NATURAL HISTORY.

TAKEN FROM THE SOCIETY'S RECORDS.

General Meeting, October 4, 1876.

The President, Mr. T. T. Bouvé, in the chair. Twenty-nine persons present.

Mr. Chas. S. Minot gave an account of the investigations of Semper, Balfour, Schultz, Dohrn, Müller, Meyer, Spengel, Brown, Rolph, and others, tending to prove a close relationship between Worms and Vertebrates, and the necessity for a new group, *Protochordatæ.*

Mr. Minot spoke of the bigeminal evolution in Annelids, and of the Annelidan character of the segmental organs of the Vertebrates. He then discussed the segmentation in Worms and other classes, and the removal of Amphioxus and the Ascidians to a side branch, away from the main stem of the Vertebrates. He finally mentioned the difficulty of explaining the origin of the limbs and the position of the mouth in Vertebrates. He concluded that the nearest relatives of the Vertebrates are not the Molluscs, but the Annelids.

A letter was read from Mr. C. F. Winslow, relating to the occurrence of Alasmadonta in the Warm Spring Lake, a mile or two north of Salt Lake City.

The tepid water of the lake is impregnated with sulphur. Besides Alasmadonta, several Helices, as well as diatoms, etc., are found. Specimens of the former, and also some Artemiæ from the Great Salt Lake, were presented to the Society.

General Meeting, October 18, 1876.

Dr. S. Kneeland in the chair. Sixteen persons present.

Dr. T. Sterry Hunt read a paper on the Quebec group, of which the following is an abstract:—

The Quebec Group in Geology. By Dr. T. Sterry Hunt.

The name of Quebec group was given by the late Sir W. E. Logan to a series of uncrystalline strata which form the heights of Quebec and much of the region adjacent, and are thence traced northeasterly along the valley of the St. Lawrence, and southwesterly as far as Lake Champlain. These strata were at first regarded by Logan as including the Utica, Loraine and Oneida divisions of the New York series, but were subsequently found from their organic remains to belong to an horizon below the Trenton limestone, and were then first named by him the "Quebec group." They correspond to the Upper Taconic series of Emmons. According to Logan, this Quebec group may be divided into three parts; the lower or Levis division, including graptolitic shales overlaid by fossiliferous limestones; the middle or Lauzon division, consisting chiefly of sandstones and shales, and not known to contain fossils; and the upper or Sillery division, a great mass of red sandstones with red and green shales, in which the only organic remains were an obscure Lingula and a species of Obolella.

The limestones of the Levis division contain a very abundant fauna described by Billings, which was shown by him to belong to an horizon near that of the Calciferous and Chazy divisions of the New York series. It is this fauna which has been looked upon as indicating elsewhere the presence of the Quebec group. These three divisions at Quebec have a measured thickness of over five thousand feet, and are found dipping at a high angle to the southeast. The whole was described by Logan as having originally occupied a position *conformably* beneath the Trenton limestone of the vicinity, and as having been brought to the surface by a great break and uplift of the strata.

The speaker however showed in 1871–2 that this fault was imaginary, and the Quebec group really occupies a position *unconformably* beneath the Trenton; and, moreover, that the series near Quebec is inverted, being probably the northwest side of an overturned anticlinal, so that the Sillery is in fact the oldest member of the series, and was followed by the Lauzon and the fossiliferous Levis limestone, to which succeeded the graptolitic shales, the newest portion of the Quebec group, corresponding to the Arenig or Skiddaw rocks of Great Britain. The Levis has a fauna equivalent to that of the Tremadoc and Dolgelly rocks of that country.

His conclusion from these facts was that the great mass of Lauzon and Sillery rocks should represent the lower divisions of the Lingula flags (Festiniog and Maentwrog), and perhaps also the older Menevian and Harlech rocks of Great Britain. These inferior strata in Canada have afforded, as yet, but few organic forms, but Mr. Billings, just before his lamented death, informed the speaker that the Obolella already mentioned from the Sillery, and an Orthis lately found near the same horizon, were both clearly Menevian species.

The relations of these rocks in Canada were illustrated by numerous sections, and the parallelism and harmony between the Quebec group, as rightly determined, and the Cambrian rocks of Great Britain and Scandinavia were insisted upon. It was urged, however, that the name given by Logan to the group, should be rejected as misleading, although that of Levis, as designating an horizon of fossiliferous strata of Tremadoc age, might be advantageously retained in American geology; care being taken to distinguish it from the Quebec graptolitic zone, which is of the age of the Skiddaw or Arenig rocks of Great Britain.

Sir W. E. Logan gave a farther extension to the name of the Quebec group by the supposition that a great series of crystalline schists to the south and east of this fossiliferous Cambrian belt was no other than these same rocks in an altered or so-called metamorphic condition. In accordance with this hypothesis, he extended the name of the Quebec group over a broad belt of crystalline rocks from the St. Lawrence to Virginia, as represented on his large geological map. These crystalline strata, however, include the Lower Taconic of Emmons, the Montalban, the Huronian, and even portions of Laurentian, although near Quebec they are of Huronian age. The author many years since pointed out that the fossiliferous Levis strata near Quebec hold in their conglomerates pebbles derived from the crystalline Huronian schists which were described by Logan as altered Levis and Lauzon rocks. These crystalline schists were by Logan maintained to belong to this horizon because they are in some places overlaid by Sillery sandstones; but inasmuch as it now appears that the Sillery is really the lowest member of the Quebec group, it is clear that these crystalline schists must belong to a more ancient series.

The thanks of the Society were voted to Mr. John Cutter, of Charlestown, for the gift of a King Fish (*Menticirrus nebulosus* Mitch.) from the Merrimack River. This is an exceedingly rare fish in our waters.

Dr. Kneeland observed that, during the past summer, the Hair-finned Dory (*Argyriosus capillaris* Mitch.) was taken in abundance near Cohasset, although previously almost unknown north of Cape Cod.

Section of Entomology, October 25, 1876.

Mr. E. P. Austin in the chair. Eight persons present.

The following paper was read: —

On the Species of Sunius and Pæderus found in the United States. By E. P. Austin.

Among the Coleoptera of the United States no large group except the Curculionidæ has been so much neglected as the Staphylinidæ; although most of the species are very common, yet, owing to their small size and superficial similarity, nearly or quite half of them remain undescribed, and they have been so neglected by collectors that comparatively little is known of the distribution of such as are described. These facts will be a sufficient excuse for the following attempt to arrange the species of the two genera, Sunius and Pæderus, as well as for the incompleteness of a paper written mainly for the purpose of calling the attention of collectors to this group, in order to accumulate the materials for a complete knowledge of it.

The species of Sunius may be divided into two groups: the genuine Sunii, which constitute the principal part of the genus, in all of which the sculpture of the upper surface of the head and thorax consists of raised lines crossing each other, so as to form lozenge-shaped areas, in the centre of each of which is a minute raised spot or tubercle, giving a peculiar appearance to the insect; while in the spurious Sunii there is no trace of this sculpture, the upper surface being simply punctate. This group, which should no doubt constitute a distinct genus, is represented in the United States by only the single species . . . . 1. *monstrosus* Lec.

The genuine Sunii may be separated as follows:

Head black . . . . **1.**

Head pale . . . . **4.**

1. Thorax and abdomen dark; elytra black, scarcely wider than the thorax, with the suture and apex more or less pale; form narrow, slender . . . . . . 2. *linearis* Er.

Thorax and abdomen dark; elytra pale, broader than the thorax; form broad . . . . . 3. *californicus* sp. n.

Thorax and three or four segments of abdomen pale . . **2.**

2. Large species 0.18 in. Elytra varying from almost entirely black to pale, with only a dusky cloud . 4. *prolixus* Er.

Smaller species .11 to .15 in. . . . . **3.**

3. Elytra longer than the thorax, with a marginal black spot on each, which sometimes increases so as to nearly cover it . . . . 5. *binotatus* Say.

Elytra not longer than the thorax, pale, or sometimes with a trace of a black spot . . . . 6. *brevipennis* sp. n.

4. Antennæ slender, as long as the head and thorax, last joint but little thickened; elytra pale, one and one-half times longer than the thorax . . . . . 7. *longiusculus* Mann.

Antennæ slender, but shorter than the head and thorax; elytra longer than the thorax, each with a dark spot
8. *centralis* Zimm.

Antennæ stouter, thickened externally, joints 8–10 transverse
9. *similis* sp. n.
10. *trisignatus* Boh.

1. Sunius monstrosus Lec. New Sp., Am. Col., 48. La. and Fla.

2. Sunius linearis Er. Staph., 639.

Among the specimens which I have put under this species there is considerable difference in the form of the elytra, which in some specimens are linear, in others considerably inflated behind the humeri, so as to be almost oval in outline, but I am unwilling to separate them without a more extended series of specimens for comparison. Can., Mass., N. Y., Mich., Ill., La.

3. Sunius californicus.

This species, of which I have seen only a single specimen from San Jose, Cal. (coll. LeConte), differs from all our other species by being very broad and stout; the head is scarcely longer than wide, the thorax almost circular in outline, and the elytra as broad as long.

4. Sunius prolixus Er., Staph. 639; *cinctus* Say (Pæderus), Tr. Am. Phil. Soc., 2d Ser., IV, 457; Say's writings; Ed. Lec., II, 572.

This is our largest species, and is found over the whole eastern part of the United States and Canada.

5. Sunius binotatus Say (Pæderus), Journ. Acad. Phil., III, 154; Say's writings; Ed. Lec., II, 99 ; Er., Staph., 645.

This species also has a wide distribution, but is much more rare. Specimens are at hand from C. W., Ill., Ohio, Mich., La., and Fla.

6. Sunius brevipennis.

This species, which is common in eastern Mass., and is also found in Mich., is closely allied to the preceding; the elytra, however, are a little shorter, and generally without a trace of the black spot, though in one or two specimens there is a faint dusky shade representing it. In this species I have noticed a singular sexual character which does not seem to occur in any of the others; in the males, only three segments of the abdomen are pale, while in the females four are pale; the same is the case in both sexes of the allied species, except in *S. binotatus*, where in general only three segments are pale in both sexes.

7. Sunius longiusculus Mannh. (Pæderus), Brachelytra, 39, 5; Er. Staph., 643; *disconotatus* Say (Pæderus), Tr. Am. Phil. Soc., 2d ser., IV, 457; Say's writings; Ed. Lec. II, 572.

This, which is the most abundant species in the Middle and Northern States and Canada, begins a small series in which the whole insect, except the two terminal segments of the abdomen, is pale. They may be separated most readily by the relative length of the antennæ; in this species they are long and slender, almost filiform, only the last joint being slightly thickened, and joints 8—10, longer than wide. The elytra are also long, being nearly a half longer than the thorax.

8. Sunius centralis Zimm., Ms.

Of this species I have only seen the single specimen in Dr. LeConte's cabinet, from S. C. The antennæ are about a third part shorter than the head and thorax, with joints 8—10 longer than wide, and the terminal one thickened. The elytra are a little longer than the thorax, with the sides much rounded and a dusky orbicular spot on the middle of each. The fifth segment of the abdomen is dark, with the hind margin pale, and the terminal segment entirely pale.

9. Sunius similis.

In this species the antennæ are of about the same length as in the last, but are much thicker, the joints 9—11, forming a club, the ninth and tenth almost transverse. This species is much stouter than *S. longiusculus*, and the elytra are shorter with no trace of a dark spot, and the fifth and sixth segments of the abdomen are dark except at the apex. Nev., S. Cal., and Ariz.

10. Sunius trisignatus Boh., Res. Eugen., 1858, 32.

This species is closely allied to the preceding; the antennæ are not quite so much thickened externally, being intermediate between *similis* and *centralis*; the thorax is a little shorter, and the elytra a little longer, so that they are about one-half longer than the thorax, and have a faint spot on each. The fifth abdominal segment is black except at apex, and the sixth has a fuscous tinge. San Diego (Coll. LeConte).

The species of Pæderus are even more closely allied than those of Sunius, particularly those in which the thorax and four segments of abdomen are red.

The following table will assist in separating the species:

Head with a median smooth space, having at most a fovea on each side between the eyes, sometimes only a few punctures . 1.

Head with a transverse flattened space in front between the eyes, mesosternum, two last segments of abdomen and knees black; elytra blue; large species (0.45 inch) . . 1. *femoralis* Lec.

1. Thorax and four segments of abdomen red . . . . . 2.

Unicolorous, red . . . . 5.

Unicolorous, blue or black . . . . 6.

Thorax red, rest of body dark blue or black . . . . 7.

2. Very large species, size and form of *femoralis* 2. *grandis* n. sp.

Large species, head with a transverse fovea on each side between the antennæ, leaving only a very narrow, median, smooth space . . . . 3. *riparius* Linn.

Medium size, antennæ thickened externally, joints 8—10 strongly transverse, 11th short, conical . 4. *littoreus* Zimm.
Medium size, antennæ slender, as long as the head and thorax, scarcely thickenedexternally, joints 8—10 longer than wide 5. *compotens* Lec.
Smaller species (.20 to .25 in.) . . . . . . **3.**

3. Elytra very short, sparingly punctured with moderate punctures 6. *palustris* n. sp.
Elytra longer, sparingly punctured with large shallow punctures; antennæ as long as the head and thorax, slender 7. *floridanus* n. sp.
Elytra short, densely punctured, particularly on the sides . **4.**

4. Thighs red, with the apical third black; tibiæ, tarsi and mouth parts dark; antennæ thickened, shorter than the head and thorax, joints 8—10 transverse . 8. *nevadensis* n. sp.
Legs and mouth parts red; knees sometimes blackish; antennæ more slender, joints 8—10 not transverse 9. *littorarius* Grav.

5. Small species; elytra sparsely and rather coarsely punctured 10. *ustus* Lec.

6. I have seen no species from the United States belonging to this group. *P. cæruleipennis* Boh. is described as being black, with the elytra blue, and is said to be from California and the Sandwich Islands; but as the localities of insects collected by that expedition are sometimes a little uncertain, it is not unlikely that the species is foreign to the United States. Several species of this group are, however, found in Mexico and Central America.

7. I have only seen a single specimen in Dr. Horn's collection, from Louisiana, belonging to this group, and merely call attention to the fact in order that collectors may look for similar species.

1. Pæderus femoralis Lec. Proc. Ac. Phil., 1858, 62.

This species is readily distinguished from any known to me by the character given in the table. Arizona.

2. Pæderus grandis sp. n.

This is closely allied to the last, but has the head more densely punctured; the elytra are greenish instead of blue, and are less densely punctured. The form of the head, however, affords the most ready means of separating them. Col. and Ariz. (Coll. Horn.)

3. **Pæderus riparius** Linn. (Staphylinus), Faun. Suec., No. 846, etc.

I have only seen a single specimen of this European species in Dr. LeConte's collection, who remarks that it is doubtfully American. It is larger than any of our species except the two mentioned above, 0.30 in.

4. **Pæderus littoreus** Zimm., Ms.

A single specimen from S. C. Head black, with a large median smooth space, and only a few large punctures on the sides and base. Antennæ, mouth parts, legs, thorax, first four segments of abdomen, and whole under side of body excepting the fifth and sixth abdominal segments, red. Thorax narrowed behind, sides nearly straight, all the angles rounded. Elytra blue, about as long as the thorax, sparingly punctured with large shallow punctures irregularly placed, but a little more dense on the sides. Abdomen sparingly finely punctured, fifth and sixth segments black, beneath coarsely, sparingly punctured.

5. **Pæderus compotens** Lec. New sp. Am. Col., 48.

I have only seen the type in LeConte's collection; the antennæ are slender, only slightly thickened externally, and joints eight to ten not transverse. Underside sparsely and finely punctured. Sacramento Valley, Cal.

The four following species are smaller and very closely allied.

6. **Pæderus palustris.**

Head black, orbicular, smooth and shining, with a few rather large punctures on the sides, in front between the eyes a deep fovea on each side containing several punctures. Antennæ as long as the head and thorax, first four and last one to three joints red, intermediate joints varying from dark red to black, thickened externally, third joint less than one and one-half times as long as the second, fourth about equal to second, following joints to the tenth gradually shorter and thicker, eighth to tenth transverse, eleventh obliquely truncate and acute on the lower side. Mouth parts red. Thorax red, round oval, very convex, equally narrowed before and behind, disk with a row of small punctures each side, and a few scattered ones near the sides; from each puncture proceeds a black bristle. Elytra blue, not longer than the thorax, sparingly punctured with shallow, broad, punctures. Abdomen with the first four segments red; terminal ones black, sparingly and finely punctured, underneath more coarsely; metasternum black, sparingly and rather coarsely punctured. Femora red, sometimes darker at the apex; tibiæ and tarsi generally red, sometimes dark but never black. Length, .20 in. Abundant in Eastern Mass., also in Mich.

7. Pæderus floridanus.

Head black, orbicular, with a few smaller punctures, a small, not very definite impression in front between the eyes, on each side. Mouth parts dark; maxillary palpi red, with the apex of third joint dark. Antennæ longer than the head and thorax, joints one to four red, following ones darker, but not black, third joint twice as long as the second, fourth one-third longer than the second, following joints to tenth shorter and a little thicker, eighth to tenth not transverse, eleventh nearly conical but little oblique. Thorax oval, sides less rounded, angles all rounded; disk with two rows of punctures on each side, and a few scattered punctures outside. Elytra blue, a third longer than the thorax, sparingly and rather coarsely punctured. Abdomen, four segments red, terminal black sparingly and finely punctate, with hairs proceeding from the punctures; metasternum black. Legs red. Length, .22–.24 in. Fla.

8. Pæderus nevadensis.

Head black, orbicular, with numerous coarse punctures on the side, which are densely placed opposite the eyes, forming a sort of fovea. Mouth parts dark red; apex of maxillary palpi black. Antennæ shorter than the head and thorax, much thickened externally, joints one to three pale, except the apex of third, which is generally black, following joints dark brown or black, terminal one sometimes a little paler, third more than half longer than the second, fourth a little longer than the second, following joints to tenth gradually shorter and thicker, eighth to tenth transverse, eleventh obliquely acuminate. Thorax red, sides rounded, narrowed behind, anterior angles strongly rounded, hind angles less rounded, disk with two rows of punctures on each side, and a few scattering ones outside, with scattered black hairs. Elytra blue, shorter than the thorax, densely and coarsely punctured and sparingly hairy. Abdomen with two terminal segments black, rest red, sparingly and moderately coarsely punctured; metasternum black, sparingly and coarsely punctured. Femora red, with the apex black. Tibiæ and tarsi dark red to black. Length, .20–.23 in.

This species, which has been confounded with *compotens* Lec., differs from that species by its smaller size, shorter and thicker antennæ, and darker feet. It is apparently the most common species in the Pacific district. I have specimens from Nevada, various parts of California and British Columbia; it is a much stouter species than the two preceding or the following.

9. **Pæderus littorarius** Grav., Mon., 142; Er., Staph., 656. *littoralis* Oliv., Encycl. meth., VIII, 627.

Head orbicular, black, sparingly and rather coarsely punctured on the sides, a depression on each side opposite the eyes more densely punctured. Mouth parts red; maxillary palpi sometimes blackish at apex. Antennæ as long as the head and thorax, a little thickened externally, joints one to four and two or three terminal ones red, the rest dark red to black, third joint a half longer than the second, fourth to tenth gradually shorter and a little thicker, eighth to tenth longer than broad, eleventh obliquely acuminate. Thorax red, oval, sides and angles rounded, narrowed behind; disk with two rows of, and a few scattered, punctures on each side. Elytra a little larger than the thorax, blue, coarsely and densely punctured, punctures sometimes confluent, particularly on the sides. Abdomen with the two terminal segments black, others red, sparingly and finely punctured; metasternum black, sparingly punctured. Legs red, with the knees and tarsi sometimes blackish. This is the most common species throughout the Atlantic region; it may be distinguished from *palustris* and *floridanus* by the more densely punctured elytra, and from *nevadensis* by the paler legs and antennæ, and by being more slender.

10. **Pæderus ustus** Lec., Proc. Ac. Phil., 1858, 62. Colorado River, Ariz.

General Meeting, November 1, 1876.

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

The following Associate Members were elected: — Mr. John E. Alden, Dr. Lucy Sewall, Miss Mary L. Hall, Miss Jenny H. Stickney, Miss Elizabeth P. Howard, Miss E. A. L. Cram, Miss Grace G. Cowing, Miss Lucia M. Peabody, Miss Cora H. Clarke, Miss L. Crocker, Miss G. E. Atkins, Mrs. M.

P. Kennard, Miss Mary E. Rice, Miss M. L. Tinker, Miss E. O. Patch, Miss Emma A. Temple, Miss Harriet E. Caryl, Miss Laura B. White, Miss Jenny M. Arms, Miss R. E. Cole, Miss Catherine J. Ireland, Mrs. J. W. Wolcott.

Prof. A. Hyatt gave a full account of what had been done upon the embryology of Sponges, and the views of different writers, supplemented by observations of his own, upon the earlier stages of several species.

His own and Barrois' observations substantially agreed in denying the existence of any gastrula stage in the siliceous, or in the keratose sponges. The egg, in passing through the morula stage, is either hollow, or develops an endoderm by delamination from the ectoderm. In most siliceous sponges the egg in the first stages of division is solid, but becomes hollow subsequently. A granular mass, however, accumulates in the interior during the later stages of the morula form in many species, which eventually fills the cavity, so that the larva again becomes solid. During the morula stage, too, it very frequently happens in the siliceous sponges that the egg is open at one pole, but closed at the other. This may, of course, be due entirely to the effect of contraction after death, but the structure which permits this at one pole and not at another, is probably of more importance. The unopened pole is closed by a large cell, and the open pole has no such plug. The division of such eggs appears to begin with three cells, but this is probably not the first stage, though the first observed by the speaker in several Halichondrida. There were in these forms only a single cell at one end of the oblong form of the larva, and two, side by side, at the other. The single cell appears to remain without division, though this was not directly observed, and serves to prevent the opening from occurring at this pole, whereas it may, and does, frequently occur by the separation of the cells, at the other pole. It is at this open pole that the enlarged cells afterwards occur, constituting the endoderm of Barrois, and eventually in nearly all the types of keratose and siliceous sponges form a sort of collar, which can be appropriately called the basal collar. Whether the polar opening persists, or is an essential characteristic in the larva from the morula stage until this period, Prof. Hyatt could not say, not having been able to follow it closely; but it is probable that this is the fact, since the space in the centre of the collar is occupied by an extension of the endoderm, which he had called the basal area. According to Barrois' observations, the hollow of segmentation is retained during the planula stage in many species, and after the cells have acquired the peculiar collars and flagelli, which are so characteristic of the young, the cells around the open pole become very much enlarged. When the sponge settles down at this pole, as it eventually does, according to Barrois these enlarged cells form the proper endoderm, or are continuous with this part when the endoderm is formed in the interior, and fills up the segmentation hollow, as above described in some of the earlier stages. Barrois does not figure this area as distinctly as Carter does, but describes it, and also the origin of the collar and spicules. These last originate in the granular mass of the interior in Chalina, as well as in the true siliceous sponges, and may be seen as bright points in the basal area. With regard to their origin Prof. Hyatt, in this instance also, as in the other stages described above, confirmvd Barrois' observations, that the spicules do not originate from the transformation of cells, at least in the larva.

Carter's observations and Barrois', show that the larva prefers to attach itself by the collar and basal area to surfaces, and the latter shows that this is due to the protrusion of the endoderm at this point. Both Barrois and Carter have seen the larva becoming attached, and studied the subsequent stages. Barrois has traced the formation of the ampullaceous sacs in the endoderm, and the hollowing out between them of the canal system, and the subsequent formation of the large cloacal opening by which this system was connected with the exterior. The effect of these observations is to confirm in the most marked manner the views entertained by various writers of the great taxonomic value of the characteristics of the Poriferæ.

Huxley was entirely in error with regard to the facts which he employed to show this point, in so far as he separated the sponges from the Metazoa, generally on account of their having many mouths instead of one mouth, calling them *Metazoa polystomata*, in contrast to the *Metazoa monostomata*. Nevertheless, he was the first to indicate the great importance of the poriferous characteristic, and MacAllister quotes him, therefore, as the authority for the Poriferæ or Polystomata when he uses that word to designate for the first time a new sub-kingdom of animals.

This is, however, not a fair statement of the case, for not only was Huxley in error with regard to his facts, but his estimate of their taxonomic value was entirely too high. By his system, which was wholly embryological, the sponges were one of the three largest divisions, equivalent, in fact, to the whole of the remainder of the Animal Kingdom, except Protozoa. Huxley had no intention whatever of showing that the sponges were a new sub-kingdom, or in any sense equivalent to such divisions as are usually represented by that term. MacAllister has really done this, and to him the credit is due of having first shown that the sponges are the equivalents, from a structural point of view, of the Vertebrata, or Arthropoda, or Radiata, taking those names in their broadest sense and application. This service is of real value as an advance in classification, and though it is accompanied by an almost wholly erroneous statement of the characteristics of the structure, due to the authorities from which the quotations are taken, it must receive due credit, as the first recorded estimate of the proper place of the sponges in our system of classification.

Special studies upon the structure of the full grown sponges first led Mr. Hyatt, somewhat more than a year since, to view them as distinct from the rest of the Animal Kingdom. This view, however, was kept back until such a knowledge of the embryology could be obtained as was necessary to prove, or disprove, as the case might be, their supposed connection with the Protozoa on the one side, and the Corals on the other. This idea was originated independently, since it was not until fully convinced of this fact, that he saw Huxley's, and subsequently MacAllister's paper; the observation, therefore, has the value of an independent investigation. In fact, an article was written for Johnson's Encyclopedia, of which the proof has not yet been received, in which no mention is made of MacAllister's or Huxley's views. So far as their separation from the Protozoa is concerned, Huxley has shown that they differ in the production and subsequent segmentation of a true unicellular egg; but his idea based principally upon Hæckel's observations, that they are polystomatous, or that the cloacal openings can be in any way homologized with the mouth opening in other animals, especially polyps, because it is found in the gastrula form in embryo, and is maintained subsequently throughout life, has been shown to be without foundation. Carter and Barrois' researches both show, that the only opening which can be be compared with the mouth of the gastrula form is usually the base of the sponge; and the latter, as described above, that the cloacal opening occurs by a breaking through of the ectoderm after the canals are formed in the endoderm. In fact, he goes so far as to attribute its appearance to the mechanical action of the presence of water which accumulates in the recently formed canals. The hollowing out of these canals in the endoderm, succeeding the formation of the ampullaceous sacs, and for the secondary purpose of supplying these extraordinary organs with food and aerated water, is not a very close resemblance to the formation of the gastrula in the Polyps, and completely demolishes Hæckel's theory of the connection of sponges and corals. In fact, there is no need of argument in this direction; the fact stands that in the larger number of sponges there are no gastrula forms at all in the young. Besides this, it is even doubtful whether in the Calcispongiæ and Halisarca this stage is not a temporary condition of the young, as Barrois seems disposed to think it is in the former. He had himself often observed what seemed an involution of the ectoderm in the ciliated larva of various species of siliceous sponges, and had only been prevented from figuring it as such by the fact that the centre was already solid with the included endoderm. Upon farther investigation, it became evident that the appearances were due to the extraordinary changes of form undergone by the larva in confinement.

Even supposing that the presence of the true gastrula stage were to be demonstrated in some sponges, and the identity of the first formed canals with the stomach of the gastrula be shown, there would still remain the most extraordinary differences. The development and structure of those singular organs, the ampullaceous sacs, containing cells so formed that each one performs the function of an independent, monad-like individual, taking in and digesting food on its own account; the fact that this monadigerous layer which lines the sac, or the interior of the canals, as in the Calcispongiæ, is not the endoderm as supposed by Hæckel, but a supplementary layer, as shown by Schultze, in the Calcispongiæ, and frequently seen by the speaker in the siliceous and keratose sponges, would still remain to be accounted for. The monadigerous layer, as shown by Barrois, is an aggregation of cells, arising from the plasma of the endoderm and resting upon it, as shown by Schultze, when the secondary cellular membrane, which properly represents the endoderm, is fully formed and lines the canals in the adult. The monadigerous layer and these ampullaceous sacs are organs without homologues in the remainder of the animal kingdom; for the attempt to trace any homology between them and the nettle cells has not the slightest element of plausability, either in the structure, uses or location of those organs in the polyps, as compared with the monad-like cells of the sponge.

Farther than this, the whole arrangement or plan of structure of the organization diverges from that of the rest of the animal kingdom as soon as the spicules and these monad-like cells appear, that is, in the larval stage, and while the embryo is still a locomotive animal. From this period the entire development hangs upon the monadigerous layer, as the important structural characteristic to which all others are subordinate. The innumerable pores penetrating the outer membrane or ectoderm, sifting the water pouring into the canals, are advantageous to the organization because they are essential in preventing all but the minutest particles of food from entering. The skeleton serves to support and keep the permanent canals from collapsing from the weight of a large massive mesoderm, or from the thinness of the walls in the fistular forms of Calcispongiæ; its place is supplied by a thickening of the endoderm and the close aggregation of the ampullaceous sacs in Halisarca. The arrangement and enlargement of the canals towards the centre, and their final opening into the central cloaca, is equally advantageous for the rapid transit of the vitiated water and excrements of the monadigerous layer through the mass to the cloacal orifices. The mechanical formation of the latter, and probably of the canals, in great part may be seen in Halisarca. In this sponge the cloacal openings and the entire canal system disappear when the sponge is alarmed by handling. Then the interior is found to be filled with numerous bag-like bodies, which are open at one end and are composed of a thick, apparently tough membrane formed by the ampullaceous sacs, with their contents, as above described. The opening is not closed even in stages of extreme contraction after the laceration of the mass. These internal organs are covered by the thick granular mesoderm which appears to have more than one layer, and above these a distinctly cellular ectoderm, abundantly perforated when the animal is expanded, but entirely homogeneous in a contracted state. When the mass begins to expand the internal openings of the bags are placed in connection with the exterior by canals opening anywhere apparently by means of the mechanical pressure of the water. The structure of these bags and the Calcispongiæ, also exhibit the simplest essential elements of sponge form. They show us, that, although the skeleton may be dispensed with, the cellular ectoderm, the mesoderm and endoderm, with its monadigerous lining layer, are absolutely essential, and that these structures must be arranged in bag-like form, with one opening at least for the ejection, and a multitude of smaller orifices or lateral pores for the introduction of water and food.

Mr. Hyatt did not desire by the above remarks to convey the impression that he was opposed to the Gastrean theory of Hæckel. On the contrary, he thought that that hypothesis has already led to the most important results for Zoology; and though it was not, and probably could not be, settled for years, it had turned the attention of naturalists to the importance of the comparative study of the early stages of the egg and showed that they had a distinct meaning. Whether this meaning had wholly, or only in part, been mistranslated by Hæckel, is a question which cannot be answered satisfactorily at present. That the gastrula is formed at an early stage of development in nearly all animals except the Protozoa, is not denied by any one, and the enunciation of this fact, though it be attended by many exceptions, had been of invaluable service. Mr. Hyatt was disposed, therefore, to investigate the exceptions which have been found, such as those above described, with the "a priori" view of finding some explanation of the absence in them of a gastrula stage, rather than to use them at present as undeniable evidence of the inapplicability of the Gastrean theory.

Mr. J. A. Allen gave a résumé of a paper about to be published by him, on North American Beavers, recent and fossil, exhibiting a series of skulls in illustration.

General Meeting, November 15, 1876.

The President, Mr. T. T. Bouvé, in the chair. Thirty-one persons present.

The following paper was read: —

On the Classification of some of the Lower Worms. By Charles Sedgwick Minot.

The rearrangement of the animal kingdom, necessitated by the general acceptance of the theory of evolution, assumes the form of a branching system. The worms have for some time been supposed to be at one of the most important points of divergence, and the study of them has therefore a greater interest than hitherto. Prof. Semper[1] has recently traced a relationship between Annelids and Vertebrates, and the study of other classes of worms reveals many much discussed connections with other higher animals. It has become, therefore, a matter of importance to see in what way worms are related to the lower divisions of animals. As the Plathelminths have long been regarded as the lowest form, I undertook an investigation of the anatomy of the Planarians.

The result of this study has been the conclusion that these animals are much more highly organized than is usually supposed. It has been frequently stated that some, or all parts of these worms are formed by a protoplasmatic substance, and not of cells, and a relationship with the Infusoria has therefore been supposed to exist. I have found, however, that all the tissues are formed by cells, and therefore we must drop the idea of a connection existing between the Turbellarians and any of the Infusoria, which, so far as we know, are all unicellular, as has been demonstrated by Bütschli.[2] The cells that earlier naturalists did not detect have since been carefully described by Keferstein, Moseley, Graaf, etc. At the time I began my investigations, about a year ago, it was still supposed that the parenchym was not cellular, but since then I have discovered that in twenty different species of Plathelminths it is mainly composed of ramified stellate cells, whose processes intertwine and unite adjacent cells. The general appearance is strikingly similar to that of the embryonic connective tissue in Vertebrates, as seen, for example, in the tail of young tadpoles.

Mecznikow[3] has asserted that the digestive tract is not a canal, but a solid albuminous cord, as in the Infusoria. He did this with so great positiveness, that no one except Graaf[4] has since ventured to vigorously oppose this view. Mecznikow mistook the nutritive matter with which the digestive canal of these greedy animals is always filled, for an albuminous cord! and though he describes the cells forming

[1] Arbeiten des Zoot.-Zool. Inst. Würzburg. Bd. II., 1875–76.

[2] Studien über die ersten Entwickelungsvorgänge der Eizelle, die Zelltheilung und die Conjugation der Infusorien. Abh. Senkenberg. Natforsch. Gesell., X, 223. Frankfurt a. M., 1876.

[3] Ueber Geodesmus bilineatus nob. Bull. Acad. St. Petersb., IX (1865), p. 433.

[4] L. Graaf. Zur Kenntniss der Turbellarien. Zeitschr. für wiss. Zoologie, XXIV (1874), p. 125 (vide p.134, note 2).

the wall of the digestive tube, he quietly assigns them to the parenchym! It is time that this hasty generalization, founded upon a careless observation, be forgotten.

The Plathelminths are all bilateral animals, and none of them present any special points of resemblance to any of the Radiata; we cannot therefore link the worms with any of the lower forms through this class. Indeed the whole class presents a number of peculiarities, sufficient to justify their temporary separation from all other forms of animals, until their real affinities shall be discovered.

The class was formerly divided as follows: —

1. TURBELLARIANS	Rhabdocœla, Dendrocœla, Nemertines.	2. TREMATODS.	3. CESTODS.

This division, however, cannot stand. The Nemertines are nowise closely related to the Dendrocœla and Rhabdocœla, but must be removed entirely from the class and put by themselves, until their proper position shall be determined. Almost every organ of the Nemertines is different from the corresponding organs in the true Plathelminths. The epidermis is in both cases a ciliated cylindrical epithelium with large unicellular glands, but this structure is characteristic of most aquatic invertebrates, that have no thick cuticula; but the singular *Stäbchenkörper* that are so characteristic for the Dendrocœla and Rhabdocœla, are entirely unknown in Nemertines. The muscular layers seem to be typically three in the former, four in the latter; but on this point there is still much uncertainty, therefore little weight can be laid upon it. The nervous system consists in Nemertines of an anterior ring around the sheath of the proboscis. This ring gives off two large cords, each consisting of central fibres and two strings of ganglionic cells.[1] There are no nervous ring nor lateral cords known in Plathelminths, but only a single central ganglionic mass in the anterior part of the body, from which radiate numerous small nerves. The two stout nerves, said by many authors to run backwards from the ganglion, I have been unable to discover in any of the twenty species I have examined, which agrees with Moseley's [2] experience.

By this observation the theory of the formation, phylogenetically,

[1] Hubrecht. Aanteekingen over de Anatomie, Histologie en Ontwikkelungsgeschichte van eenige Nemertinen, Utrecht, 1874.

[2] Moseley. On the Anatomy and Histology of the Land Planarians of Ceylon. Phil. Trans., 1874, p. 105.

of the ventral nervous cord of Annelids, out of the union of two lateral nerves, is rendered very doubtful; for the theory started from the supposed existence of such nerves in Turbellarians, the so-called lowest worms. The reproductive system reveals equally noteworthy differences. The Nemertines are diœcious, the sexual glands are small, and arranged in equidistant pairs; there is no special efferent duct with several specialized parts, as in the Plathelminths, but the sexual products are discharged by the bursting of the walls of the gland sacks in which they are developed. The yolk glands, for which I propose the more appropriate name of egg-foodstocks, or more simply foodstocks (Einahrungsstöcke), are very characteristic of the whole class, except the Nemertines, where they are utterly unknown. The Nemertines have a circulatory system, with three principal longitudinal vessels having special muscular walls — while they have no water vascular system; while just the reverse is true of the genuine Plathelminths, which have no blood vessels. The digestive canal of Nemertines is formed by a strongly differentiated œsophagus and a straight tube having an anus posteriorly. In the Plathelminths there is no distinct œsophagus, though there is often a muscular pharynx, which the Nemertines never possess. Their supposed nearest relatives, the Dendrocœla and Rhabdocœla (in part), have a prehensile proboscis connected with the mouth, but are without any anus. Finally, the proboscis of the Nemertines is still a morphological mystery; it is contained in a sheath that lies over the digestive canal, and passes through the nervous ring. There is no similar structure known among Plathelminths, unless it be the proboscis of Prostomum. I have endeavored elsewhere[1] to show that there is no correspondence yet proved.

These differences seem to me sufficient to render the removal of the Nemertines from the class of the Plathelminths unavoidable. Where they belong is another question which I cannot answer; there are indications of a relationship with the Annelids. It is to be hoped that Prof. Semper will discuss this question in his forthcoming memoir.

The remaining forms are so closely related that their more important characteristics may be easily summed up in general terms. The epidermis is formed of epithelial and glandular cells, resembling those of leeches; there is a thin cuticula, and a thick fibrous basement membrane, which is very characteristic, and separates the muscular

[1] Semper's Arbeiten. Bd. III, Hft. 4.

layers from the base of the epidermal cells. The descriptions hitherto given of the epidermis of Cestods, and probably also of the Trematods, are incorrect. The true epidermis has never yet been mentioned, for it falls off very easily, leaving behind the thick basement membrane, which has been described as the cuticula by all authors since Leuckart,[1] and consequently the subepidermal layer of gland cells has been wrongly held for the epidermis. The muscles form several layers under the basement membrane (*Hautmuskeln*), and pass as sagittal fibres through the parenchym in various directions. They are highly developed, except in the parasitic forms, where the various layers are less differentiated. There seem to be typically three layers of body muscles, an external longitudinal, middle transverse and interior longitudinal; but in many forms one or the other of the layers is apparently wanting. There are frequently suckers (Trematods, some Cestods, and among the Dendrocœla, *Eurylepta argus* and *Mesodiscus* nov. gen.), which always consist chiefly of parallel fibres perpendicular to their surface. The digestive canal has only one opening, and is lined by a cylindrical epithelium. It is wanting in Amphilina[2] and all Cestods. When present, it is provided at its anterior end either with a muscular pharynx (Trematods and some Rhabdocœla) or with a prehensile muscular proboscis (Dendrocœla and most Rhabdocœla). The canal itself is either a simple tube or sack, or it forks shortly behind the pharynx or proboscis. The space between the digestive canal and the epidermis is filled with muscles and connective tissue, which is formed of stellate and round cells, encloses unicellular glands, and is furnished with many cavities in which the remaining organs lie, and which may therefore be regarded as the representatives of the body cavity. This connective tissue is called the parenchym. The nervous system consists of a single anterior ganglion, built up by a central meshwork of fibres, and of peripheral ganglionic cells. Nerves radiate from it in various directions. It is most distinct and compact in marine Planarians. It has a simpler form in the Trematods, and is entirely wanting in Cestods. Schneider describes a nervous system in Ligula, etc., mistaking another structure for it, as I will explain presently. Eyes are not found in the parasitic

[1] R. Leuckart. Die Menschlichen Parasiten, Bd. I, p. 167.

[2] Salensky. Ueber den Bau und die Entwickelungsgeschichte der Amphilina G. Wagen. (Monostomum foliaceum Rud.) Zeitschr. f. Wiss. Zool., XXIV (1874) p. 291.

[3] Untersuchungen über Platthelminthen. Giessen, 1874.

forms, but occur in all the others with the exception of Typhlolepta Leidy. They are formed of a cup-shaped pigmented layer enclosing a clear substance; the open end of the cup points upward. The eyes are situated underneath the dorsal epidermis, either in or below the muscles, and are usually numerous. Other sense organs are unknown. The sexes are always united in one individual. We distinguish sexual glands, efferent ducts and the apparatus for copulation. The testicles usually lie dorsally, the ovaries ventrally. Both may vary greatly in number, in some cases there being but one gland, in others two symmetrical glands, in still others numerous small ones for each sex. The number of male and female glands does not always vary in the same way in each species; thus Taenia has one ovary and numerous testicles, while Distomum has also one ovary but usually only two testicles. From the sexual glands run ducts, lined by a cylindrical epithelium. The ducts are ramified to correspond to the number of glands. The female apparatus is further complicated by the addition of a singular gland, the Eggfoodstock (*Yolkgland*, *Dotterstock*), which produces cells, which remain alive, and pass down a separate duct, that ultimately joins the oviduct. The cells are then thrown together with an egg cell, and the whole cluster of cells is covered over by a shell. In the Cestods and Trematods there is a widening of the oviduct not far from the point where the food duct unites with it. This enlargement has glandular walls which secrete the shell. The egg as laid consists of the egg proper and the food cells which are used up to nourish the egg as it grows. This curious economy is unknown outside of the Plathelminths. The lower end of the oviduct is enlarged and known as the uterus. There is frequently a terminal chamber, the female antrum, by which copulation takes place. There is also a male antrum, and we not seldom find the two sexual antra united to form a single one. The sperm-duct terminates in a penis, the upper end of which is enlarged and fixed, and has been named *Cirrhusbeutel* by the Germans. The lower end (Cirrhus, penis proper) can be everted, and is inserted during copulation into the female opening. It sometimes has a flagellum (Dendrocoelum, Taenia, etc.). The Trematods and Cestods have a special tube and opening for the introduction of the sperma into the female apparatus. This tube, known as the vagina, exists beside the oviduct (Uterus *auct.*), but does not exist in the Turbellarians. Stieda[1] was the first

[1] Stieda. Ueber den angeblichen inneren Zusammenhang der männlichen und weiblichen Organe bei den Trematoden. Arch. für Anat. u. Physiol. 1871.

to draw attention to this point. There are two vaginæ in Polystomum.[1] Concerning the water vascular system there exists much doubt; I have treated this point elsewhere. I have finally to mention peculiar cords of parenchymatous tissue that run lengthwise through the body of numerous Plathelminths. These were first noticed by Sommer and Landois in Botriocephalus, then by Mosely in the Land planarians, and by Salensky in Amphilina, and were considered by all these authors to be part of the water vascular system. Nitsche[2] showed that it could not be, because the cords (*Balkenstraenge*) exist in *Taenia* beside the true water vascular system. I have been unable to determine what these structures really are, although I have met with them in a variety of Planarians. They are what Schneider took for nerves in Ligula.

It appears from the above account that the Plathelminths are all closely related, so far as we can judge from the structure of the adult forms. I have never investigated the development of the class.

The Trematods and Cestods agree with one another and differ from the other members of the class in having a vagina, a simple muscular system, and digestive apparatus, a very simple ganglion or none at all; presenting, in short, reduction of all those organs that are unessential to parasitic life. I propose, therefore, to unite them under the name of *Vaginiferae*. The union of the two orders is rendered still more natural because there is a gradual passage from the segmented Cestods to the ordinary Trematods. This passage is formed by Taenia, Botriocephalus, Triaenophorus, Ligula, Caryophyllaeus, Amphilina, Distomum. Similarly the Dendrocœla must be united with all those Rhabdocœla that have a proboscis. For this group I propose the name *Pharyngocœla*, which has already been used by Prof. Leuckart in his Jahresberichten. The remaining Rhabdocœla may be classified in the way proposed by Ulianin[3] in two groups, *Apharyngea* and *Acœla*.

[1] Zeller. Weiterer Beitrag zur Kenntniss des Polystomum. Zeit. wiss. Zool. Bd. XXVII (Heft 2, 1876), p. 238.

[2] Untersuchungen über den Bau der Taenien. Ibid., XXIII, p. 195.

[3] Ulianin. Die Strudelwürmer des Sebastopolischen Hafens. Moskau, 1870. Verhand. zweiten Natforsch. Versamm. in Moskau (in Russian).

The classification of the Plathelminths therefore assumes the following form: —

ACŒLA,	
APHARYNGEA,	
PHARYNGOCŒLA,	*Rhabdocœla.*
Rhabdocœla,	
Dendrocœla,	*Dendrocœla.*
VAGINIFERÆ,	
Trematods,	*Trematods.*
Cestods,	*Cestods.*

Besides these forms, Microstomum and the Gastrotricha have been classed together with Turbellarians. The former have hardly been studied anatomically yet. It is, on the other hand, probable that the latter are really related to the Apharyngea. In this case the Plathelminths would be brought into relation with Bütschli's new group, the *Nematorhyncha*.[1]

If the Plathelminths were, on the other hand, related directly to the higher worms, we should expect to find some points of close resemblance in structure, which however we do not. The affinity formerly supposed to exist between them and the leeches has been found, upon more accurate investigation, not to be genuine. It appears to me very probable that our class may be related to the Nudibranchs. I hope to be able to investigate this point shortly, and will not therefore discuss what is at present a mere hypothesis.

I have finally to state that the investigations, the general results of which I have here communicated, were made in the laboratories of Profs. Semper and Leuckart, to whose invaluable assistance much of the worth these studies may have must be attributed. I must thank them warmly for their help. The extended memoir will, I hope, be published before long in Prof. Semper's Arbeiten des Zootomisch-zoologischen Instituts zu Würzburg.

NOTE. Since writing the above, I have received Professor Semper's very important and interesting memoir[2] on the homologies existing between worms, vertebrates and arthropods. He has opened a vast field of new discoveries, and discusses the relationship

[1] Bütschli. Untersuchungen über freilebende Nematoden und die Gattung Chaetonotus. Zeit. wiss. Zool., XXVI (1875-76), p. 392.

[2] Semper. Die Verwandtschaftsbeziehungen der gegliederten Thiere. III, Strobilation und Segmentation. Ein Versuch zur Feststellung specieller Homologien zwischen Vertebraten, Anneliden und Arthropoden. Arbeit. Zool. Inst. Würzburg, Bd. III, p. 115 (1876).

of all those classes of animals indicated in the title, and then attempts to connect the Plathelminths through the Nemertines with the Annelids. It seems to me that he fails of success, for he bases his conclusions mainly (1) upon the idea that the two lateral nervous cords are really present in the Planarians, and (2) upon some observations which he himself made upon Microstomum. As regards the first point, I have already stated that Mosely and myself, the only investigators who have extensively applied modern methods of microscopical research to the study of the PHARYNGOCŒLA, were unable to find these supposed nerves, though we discovered other cords formed of parenchymatous tissue, which run where the supposed nerves were said to be, and I know of not the slightest reason for not thinking that the observation of these cords led earlier writers to describe the imaginary lateral nerves. The mistake was the more natural since the parenchymatous cords run close up to the central nervous ganglion. As regards the second point, it is undoubted that Prof. Semper's observations reveal similarities between Microstomum and the Nemertines, but in so doing I think he cuts off all possibility of connecting it any longer with the Platthelminths. He says that it has an œsophageal nervous ring,[1] which, combined with its peculiar reproduction by division,[2] is sufficient to indicate that it is not a Plathelminth. The structure of the sexual organs, when it shall be known, will decide the question. Search should be made for a yolk gland, and for special genital ducts, such as characterize the flat worms, and for genital sacks arranged in pairs and without a common efferent duct as in the Nemertines. At present certainly Microstomum cannot be considered to link the Plathelminths with the Nemertines, nor to remove the former class from the singularly isolated position in which we are obliged to place them, for the time being at least. I have here entered into this subject because it appears desirable to show that the belief, that the Planarians belong in the system of classification near the point where the various forms of bilateral animals branched off, is without sufficient basis. In other words, it is not yet known to what animals lower in the scale the Nemertines and Annelids are related.

Mr. Minot also exhibited and described the "sledge microtome," made by Leyser of Leipzig.

[1] L. c., p. 369 ff.

[2] Cf. Graaf. Zeit. f. wiss. Zool., XXV (1874–75), p. 408.

Dr. J. B. S. Jackson remarked that a specimen of the pelican (*P. erythrorhynchus*) had been shot recently near Cohasset, Mass., and inquired how frequently it was found in the State.

Dr. T. M. Brewer replied that this bird is now a rare visitor, although breeding farther north in great numbers. Mr. J. A. Allen remarked that the specimen referred to by Dr. Jackson was the third shot in the State within late years, but that the pelican was once a common bird here.

In the name of Dr. G. A. Otis, of the U. S. Army Medical Museum, Dr. Jackson presented a photograph of Dr. Jeffries Wyman, from a picture taken a few months before his death. Mr. F. W. Putnam also promised a smaller copy of the same picture in Dr. Otis' name. The thanks of the Society were voted to Dr. Otis for these valuable memorials of its late President.

A large collection of microscopical slides, prepared by the late Wm. Glen, purchased for the Society by Mr. R. C. Greenleaf and Dr. A. D. Sinclair, and carefully catalogued by the former, was also presented.

General Meeting. December 6, 1876.

The President, Mr. T. T. Bouvé, in the chair. Forty-three persons present.

After opening the meeting as usual, the President said: —

The Society is again called upon to deplore the loss of a valuable member and officer in the death of our late Treasurer, Mr. Edward Pickering.

Previous to our last meeting Mr. Pickering had been ill for a day or two from a trouble in his throat, affecting the vocal organs, and making it painful for him to converse freely, but he kept about his usual occupations until a few hours before we met, when feeling unable to be with us, he sent to me his regular financial statement for presentation to the Council in the evening. The trouble with him seemed similar to what he had before experienced, and there appeared no reason to anticipate its sad result. All, I am sure, were surprised and shocked to learn on the following Tuesday that he had passed away early that morning.

Mr. Pickering, though, not strictly speaking, a scientific man, was much interested in whatever conduced to the education of the community, and he consequently felt great interest in the well-being and success of our Society. He became a member in 1860, since which time he has always been a regular attendant on the meetings, and I think from his highly appreciative mind greatly enjoyed the proceedings. In 1865 he was elected Treasurer of the Society, and he became also, *ex officio*, one of the Trustees, meeting the requirements of these positions with great devotion and efficiency.

Our departed friend acquired the high respect of all who knew him, by his general intelligence, his marked integrity, and his faithfulness to all the duties of the various offices he was called upon to fill, and he won the love of all who knew him intimately by his kindly sympathy and his Christian gentleness.

On motion of Messrs. Scudder and Hyatt, it was voted that the Secretary send a copy of the President's remarks to the family of Mr. Pickering, as an expression of the Society's respect and regard for him.

The following papers were presented: —

A Century of Orthoptera. Decade VII. — Acrydii. By Samuel H. Scudder.

61. Caloptenus nigrescens. Dull wood-brown, the sides and tegmina marked with black. Antennæ reddish brown, a little infuscated at the tip; front of head more or less infuscated; the upper border of the eye margined by a pale yellowish stripe followed inferiorly behind the eye by a more or less distinct broad blackish belt, which extends onto the thorax, where it infuscates the upper third of the deflected lobes, especially anteriorly, and deepens to black next the lateral carinæ; metathoracic epimera yellowish or pale yellowish brown, edged on either side with black; anal field of tegmina testaceous, the remainder black, the extreme tip testaceous; fore and middle legs dull fusco-testaceous; the hind femora yellow, more or less tinged with brownish, with a broad black band on either side of the middle, whose edges follow the impressed lines, the basal one sending a median shoot to the base; hind tibiæ vinous red, a little infuscated at the base, the spines black. Vertex between the eyes broader than (♀) or scarcely as broad as (♂) the basal joint of antennæ, broadly and shallowly sulcate; frontal costa broad, subequal, sulcate throughout excepting just above the antennæ. Pronotum with equal sides, the transverse sulcations moderate, continuous, nearly straight, the median carina distinct on the posterior lobe. Tegmina only half as long as the abdomen, tapering, the inner margin convex, wings slightly shorter. Hind femora stout and long. Male abdomen normal, the cerci moderate in size, compressed, tapering and straight on the middle half, with an obscure inner superior basal tubercle; beyond the middle bent inward and a little upward, equal, the tip squarely docked with rounded angles; last inferior segment pointed. Length, ♂, 23 mm., ♀, 26.5 mm.; of antennæ, ♂, 13 mm., ♀, 11; of tegmina, ♂, 9 mm., ♀, 9.5 mm.; of hind femora, ♂, 13.5 mm.; ♀, 16.5 mm.

1 ♂, 1 ♀. Georgia, H. K. Morrison.

Paroxya (Oxya, nom. gen.) nov. gen.

Body straight, subcylindrical. Head moderately large, subdeclivant, the eyes large, prominent, separated from each other above by fully (♂) or very much more than (♀) the width of the basal joint of antennæ; the fastigium rather broad, slightly depressed, the frontal costa as in Caloptenus; antennæ long, equal, of similar length in the two sexes, the joints sub-depressed, beyond the middle punctate. Pronotum simple, smooth (the posterior lobe punctulate), the median carina slight, equal; the anterior scarcely longer than the posterior lobe, the hind border of latter obtusely and bluntly angled; lower border of deflected lobes very obtusely angled in the middle; tubercle of prosternum prominent, subcylindrical, bluntly pointed, at the base laterally compressed, at least in the male; mesosternal lobes separated in both sexes by the width of the mesothoracic trochanters; metasternal lobes either closely approximate (♂) or as distant as the mesosternal lobes (♀). Tegmina and wings about reaching the tip of the abdomen, slender. Hind femora reaching (♂) or surpassing (♀) the tip of the tegmina, moderately stout but tapering very regularly, unarmed above, the genicular lobes produced but rounded; spined margin of hind tibiæ smooth, scarcely dilated toward the tip. Edges of inferior valve of ovipositor smooth; anal cerci of male having the general structure of those of Caloptenus.

This genus bears a close general resemblance to the gerontogeic Oxya Serv., but differs strikingly from it in the separated metasternal lobes of the female, the blunt tips of the geniculations of the hind femora, and the want of lateral carinæ on the upper surface of the hind tibiæ.

62. **Paroxya atlantica.** Dull olivaceous, excepting the top of head, thorax and tegmina, which vary from light to dark brown. Head olivaceous yellow on face and sides, in the female more or less infuscated; above the antennæ brownish fuscous, more or less tinged with castaneous; behind the eye a broad, straight, horizontal, black band, edged more or less distinctly, both above and below, with yellowish; antennæ not half so long as the body in the male, pale yellow at base, at least in male, beyond testaceous, deepening into fuscous toward the tip. Upper surface of pronotum of the color of the top of the head, the upper half of the deflected lobes with a very broad black band, in continuation of that on the head, anteriorly edged more or less distinctly, both above and below, with yellowish, and fading out before, or abruptly terminating at, the posterior lobe; pleura with a horizontal stigmatal stripe running backward from the hinder edge of the mesothoracic episterna (sometimes confined to the mesothoracic epimera), and an oblique stripe nearly following the division line between the metathoracic episterna and epimera; when the lower stripe is complete it renders the metathoracic episterna conspicuous, especially in the male, on account of the wedge-shaped oblique yellow dash which lies between these two black stripes. Tegmina nearly uniform brownish fuscous, with a faint line of small fleckings down the middle in the female. Legs of the color of the body, the middle and hind femora generally more or less infuscated on their outer face, the upper half of the genicular lobes of latter black; hind tibiæ glaucous with black or blackish spines. Length, ♂, 21 mm., ♀, 28 mm.; of an-

tennæ, ♂, 10 mm., ♀, 12 mm.; of tegmina, ♂, 16 mm., ♀, 18 mm.; of hind femora, ♂, 13 mm., ♀, 15.25 mm.

10 ♂, 9 ♀. New Haven, Conn., Prof. S. I. Smith; Middle States, Baron Osten Sacken; Georgia, H. K. Morrison.

63. Paroxya recta. Olivaceous yellow, brighter and more yellow in the male, duller and more greenish in the female; the upper surface of head and thorax and the tegmina wood-brown with a slight olivaceous tinge. Front of head slightly plumbeous; antennæ two thirds as long as the body in the male, yellow at the extreme base, beyond castaneous, the apical half dark fuscous with pale incisures; sides of head and thorax marked as in the preceding species, but with more brightly contrasting colors, and with only inconspicuous and incomplete pleural stripes. Tegmina of female like those of the male, without flecks, and with a slight olivaceous tinge. Sides of hind femora deepening to greenish, the hind tibiæ of a deeper glaucous than the preceding species. Besides these points of distinction from *P. atlantica*, it is a considerably larger species, and appears to have a less sharply angulated hinder border of pronotum. Length, ♂, 29 mm., ♀, 41 mm.; of antennæ, ♂, 19 mm., ♀, 15.5 mm.; of tegmina, ♂, 18 mm., ♀, 25.25 mm.; of hind femora, ♂, 15.5 mm., ♀, 21 mm.

3 ♂, 4 ♀. Georgia, H. K. Morrison. Enterprise, Florida, May 15. E. A. Schwarz, No. 423.

64. Mermiria alacris. Yellowish green, marked with roseate ferruginous and fuscous. Head green, with a broad median longitudinal ferruginous stripe, more or less infuscated anteriorly (occasionally obsolescent), and a slightly brighter, though sometimes infuscated and almost equally broad belt behind the eye; a similar but narrower stripe passes from the base of the antennæ to the anterior base of the mandibles, broadening below; antennæ ferruginous. Pronotum marked as in *M. neomexicana*, but with roseo-ferruginous instead of blackish ferruginous. Tegmina green, the posterior half more or less infuscated or tinged with ferruginous. Hind femora dull green, linearly infuscated; hind tibiæ pale and rather dull red, the spines pale on the basal, black on the apical half. Length, ♂, 33 mm., ♀, 46 mm.; of antennæ, ♂, 15 mm., ♀, 16 mm.; of tegmina, ♂, 23 mm., ♀, 35 mm.; of hind femora, ♂, 18 mm., ♀, 25 mm.

32 ♂, 2 ♀. Georgia, H. K. Morrison. This species resembles the most closely *M. neomexicana* (*Opsomala neomexicana* Thom., *M. Belfragei* Stål), being, like the latter, clearly distinct from *M. bivit-*

tata (*Opomala bivittata* Serv.), in the shape of the fastigium of the vertex. All three species occur in Georgia, so that Thomas' name is unfortunate. *M. alacris* differs from *M. neomexicana* in having the fastigium of the vertex still more produced and more pointed, the anal cerci of male a little shorter, the last ventral segment of the same sex less produced, in the lighter coloring, roseate or roseo-ferruginous taking the place of dark fuscous or blackish, and in the greater diffusion of green over the tegmina.

65. **Hippiscus lineatus.** Frontal costa expanded at the ocellus, more constricted below than above, expanding toward and extending to the clypeus. Head brownish yellow, mottled with ferruginous, the antennæ blackish beyond the basal third. Pronotum darker than the head, the superior surface minutely punctate and a little rugulose in short straight ridges, those of opposite sides slightly diverging. Tegmina brownish fuscous, flecked with clustered spots of dark brown, sometimes deepening on the basal half into blackish; they are mostly confined to narrow irregular bands, one of which is premedian, a second lies nearly half way between this and the base, and a third as far toward the apex, beyond which the spots are small, few and irregularly distributed; the ulnar veins and its immediate borders (forming the angle of the closed tegmina) are pale yellow, forming a stripe nearly the entire length of the tegmina. Wings pale yellow at base, pellucid at tip with one or two small obscure fuliginous spots and black nervules; and in mid-wing a broad black arcuate band, which follows the outer border, diminishing in width as it goes, fully two thirds the way to the anal angle; the outer limit of this band is a nearly straight line from a point on the costal margin, about three fifths the distance from the base, to the tip of the second or third anal ray; it is divided narrowly by a narrow straight pale yellow stripe (which, as in the tegmina, follows the ulnar vein), and extends broadly above the ulnar vein half way to the base. Hind femora brownish yellow, with a couple of faint oblique darker bands; tibiæ dull yellow, darkest below (perhaps reddish in life), the spines black tipped. Length of body, 32 mm.; of antennæ, 11 mm.; of tegmina, 31 mm.; of hind femora, 15 mm.

Described from a single female, dried after immersion in alcohol, taken by Dr. A. S. Packard in Manitou, Colorado.

66. **Trimerotropis picta.** Head yellowish brown, obscurely dotted with fuscous, the front more or less ashen or pallid; frontal costa deeply sulcate excepting above; lateral foveolæ equitriangular;

fastigium flat, distinctly declivant, the sides gradually raised, the space between the eyes nearly double that of the frontal costa; antennæ reddish, testaceous on the basal, blackish fuscous on the apical half. Pronotum yellowish or brownish testaceous above, flecked with black dots, the sides more or less cinereous, with an obsolescent blackish stripe next the lateral carinæ; the front lobe rather constricted, its median carina seldom cut distinctly by the transverse sulcus, being generally but little lower where it meets it, than elsewhere. Tegmina with a series of large, irregular, light brown or cinereous spots along the costal border, each made up of a series of clustered blackish dots on a pale ground, next to which the tegmina are black or brown, often deepening to black; paler again on the anal area, but flecked with black dots; the costal spots generally consist of a long basal spot reaching nearly to the middle of the wing, and broader or less broken in its apical half, a smaller, generally subquadrate spot, opposite the tip of the ♂ abdomen when at rest, and midway between that and the tip one or two smaller, similar, often triangular spots. Wings with a large, subquadrate spot of a somewhat umber yellow color, with ragged borders, occupying the basal third; the rest of the wing blackish fuliginous, sometimes almost black, with a pellucid or semipellucid, narrow, transverse, preapical, straight band, broadest and clearest in a subtriangular space above, the middle of which lies below the apex of the castaneous stigma; extreme edge of preanal area white. Hind femora cinereous, crossed, either side of the middle, by two narrow transverse blackish fuscous bands; hind tibiæ coral red, cinereous at base, the spines red, black tipped. Length, ♂, 20 mm., ♀, 25 mm.; of antennæ, ♂, 10.5 mm., ♀, 11 mm.; of tegmina, ♂, 24 mm., ♀, 25.5 mm.; of hind femora, ♂, 11 mm., ♀, 12.5 mm.

42 ♂, 17 ♀. Florida, P. R. Uhler; Cedar Keys, June 4, E. A. Schwarz, No. 441; Ft. Reed, J. H. Comstock; Georgia, H. K. Morrison.

67. **Leprus ingens.** Head rather tumid, rugulose throughout, uniform dirty brown; eyes separated above by fully their own width; vertex with a very slight median carina, which scarcely enters the fastigium, lateral foveolæ inconspicuous, scarcely depressed, with no carina separating them from the front border of the eyes; frontal costa broad, equal excepting at the ocellus (where it expands considerably), broadly, shallowly and somewhat irregularly sulcate; antennæ scarcely as long as the pronotum, variegated, but with a general livid brown color. Pronotum of the color of the head, rugose, with the

anterior lobe subtumescent in the middle posteriorly, and with a broad and deep transverse depression on the front of the posterior lobe, divided into halves by the sharp, but only here at all elevated, median carina; posterior border crenulate, broadly rectangular, the lateral carinæ sharp but not elevated, confined to the posterior lobe. Tegmina as long as the head and pronotum together, broad, subfusiform, tapering rather rapidly and regularly on the apical half, the apex well rounded, the whole of the color of the thorax, flecked with rather large, roundish, inconspicuous, dusky spots, the larger ones mostly collected in two transverse submedian rows, the smaller ones scattered about the apex. Wings short and broad, lemon yellow on the basal two thirds, or more; beyond it, in the anal field, a transverse straight dusky fuliginous band, which unites above with a broader longitudinal similar band running halfway to the base next the upper border of the anal field, and gradually fading; beyond these the wing is pellucid, with black veins, and at the very tip again a little infuscated. Hind femora clay-brown mottled with griseous, the broad superior and inferior expansions grimy, but their extreme edges yellow; the interior surface dark blue, pale salmon at tip; hind tibiæ pale coral red, the outer posterior face (and base of spines), especially above, white; tips of spines black. Length of body, 37 mm.; of antennæ, 10.5 mm.; of pronotum, 11.5 mm.; of tegmina, 19 mm.; of hind femora, 21.5 mm.; breadth of same, 8 mm.

1 ♀. Sauzalito (near San Francisco), California, June 7, Mr. J. Behrens. Another species of this genus was taken by Baron Osten Sacken, in Sonoma Co., California.

68. **Brachystola Behrensii.** Of the same size and general appearance as *B. magna* (Gir.), but differing from it strikingly in its markings and some minor points of sculpture. The carinations of the head are the same; the eyes are scarcely larger; antennæ luteous, with black incisures on the basal half, blackish fuscous beyond. Sides of the upper surface of the pronotum more declivant, the median carina slightly sharper, the hind border produced and well rounded; upper surface dark brown mottled with yellowish, the front and hind border of lateral lobes narrowly, and the inferior border broadly, yellowish, the remainder of the lateral lobes black. Tegmina a very little smaller than in *B. magna*, roundish, black, with yellow longitudinal veins. Hind femora noticeably slenderer than

in *B. magna*,[1] rather flatter above, transversely marked with dull yellow and brown, the apex black; hind tibiæ yellow, infuscated at the extreme tip, the spines wholly black. Abdomen brownish yellow, the dorsum with a broad median fuscous stripe, sometimes enlivened by a median luteous line, separated by a narrow subdorsal luteous stripe from a broad, black or blackish, dorso-pleural stripe. Indications of similar markings may often be seen in *B. magna*, but they are never so unequal nor so intense. Length of body, ♂, 46 mm., ♀, 55 mm.; of antennæ, ♂, 27 mm., ♀, 25 mm.; of pronotum, ♂, 15.25 mm., ♀, 17.25 mm.; of tegmina, 8 mm., width of same, 6.75 mm.; length of hind femora, ♂, 30.75 mm., ♀, 25.75 mm.

1 ♂, 1 ♀. Sinaloa, Mex., J. Behrens.

69. **Tettigidea obesa.** Shining nigro-fuliginous, the dorsum of pronotum sometimes dull plumbeo-testaceous; lower two thirds of face of male and lower third of deflected lobe of pronotum pale clay brown; legs and tegmina black, the hind femora sometimes with an inferior premedian and superior preapical minute testaceous spot. Body very robust and unusually smooth, the entire head and pronotum being depressed, rugulose and shining; all the angles are rounded. The fastigium of the vertex is broadly rounded in front, scarcely projects beyond the eyes, but the median carina, continuous with the frontal carina, is conspicuous and prominent, compressed, though with rounded surface; the frontal costa is very prominent, broadens slightly below, and is very narrowly sulcate; seen from the side, it projects beyond the eyes fully half their width, and is broadly convex. The pronotum reaches the tip of the abdomen only, is produced and very convex in front, and, at least in the females, is fully twice as broad in the middle as in front; its sides are considerably deflected, so that the median carina is elevated and equal throughout, though blunt, and on a side view somewhat arched. The tegmina are almost smooth, and the wings scarcely longer than the pronotum. Length, ♂, 9 mm., ♀, 12 mm.; of antennæ, ♂, 3.75 mm., ♀, 4 mm.; of hind femora, ♂, 6 mm., ♀, 8 mm.

3 ♂, 3 ♀. Georgia, H. K. Morrison. The heavy, smooth and rounded body of this insect readily distinguishes it from any other Tettigidean known to me.

70. **Tettigidea prorsa.** Varying from dark testaceous to blackish, generally darkest on the sides, but the face and lower third

[1] The hind femora of the females are much slenderer than those of the males in this genus.

of pronotum generally pale yellow in the male; antennæ luteous, black on apical fourth or less. Face more than usually oblique; eyes not so prominent as usual; fastigium broadening greatly in front, its anterior edge forming with the contour of the eyes an almost continuous curve, subangulated in front, giving the head a bluntly conical aspect, very different from that of any species known to me; near the extreme tip of the fastigium commences a low, blunt, but moderately stout carina, continuing down the face as the frontal costa, where it is very prominent, compressed, equal, convex on a side view and slenderly sulcate. Pronotum rather slender, but only as long as, or even shorter than, the abdomen, scabrous, the front margin broadly convex, the median carina distinct, but not very elevated, the outer edges beyond the sinus marginate, and between them and the median carina two or three vein-like dull longitudinal ridges. Tegmina nearly smooth, wings no longer than pronotum. Length of body, ♂, 8.5 mm., ♀, 11 mm.; of antennæ, ♂, 3 mm., ♀, 3.6 mm.; of hind femora, ♂, 5 mm., ♀ 7 mm.

3 ♂, 3 ♀. Georgia, H. K. Morrison.

New Forms of Saltatorial Orthoptera from the Southern United States. By Samuel H. Scudder.

Gryllus Saussurei. Head ample, tumid, smooth, piceous; the front, sides and margins of the eyes, excepting behind, luteous; antennæ luteo-fuscous, lighter at base; mouth parts luteous, irregularly infuscated. Pronotum broader than long, slightly narrower behind than in front, the anterior border slightly concave, the posterior straight; blackish, faintly irrorate with luteo-fulvous, the front margin sometimes faintly edged with the same; the lower half of the deflected lobes pale luteous, edged very narrowly below with black, the upper half of the lobes darker than the upper surface and uniform; front and hind border with a few curved black bristles. Tegmina covering about two thirds of the abdomen, testaceous, the humeral angle blackish, the basal half of the lateral field pale luteous; wings almost wanting. Legs yellowish brown, the hind tibiæ and sometimes the apical half of hind femora infuscated externally; tympanum of the fore tibiæ fully one third the length of the tibiæ on its outer face, wanting on the inner face. Abdomen black; cerci fusco-luteous, about as long as the hind femora. ♂. Length of body, 11.5 — 13.5 mm.; of antennæ, 18 — 20 mm.; of tegmina, 6 mm.; of hind tibiæ, 5.5 — 5.75 mm.; of cerci, 8 mm.

Georgia. This species, one of the smallest in N. America, resembles the larger *G. personatus* Uhl. in general appearance, especially in the pale sides of the pronotum, which in *G. personatus* are devoid of black, excepting a small spot above.

Nemobius carolinus. Head and unicolorous antennæ varying from dull luteous to dusky brown, furnished with rather long, curving, distant, black, bristly hairs. Pronotum of the color of the head, but more or less mottled, a little broader than long, supplied with long bristly black hairs rather less abundant than in *N. vittatus*, its anterior two thirds with a distinctly impressed median line. Tegmina shining black, the borders and angles testaceous, those of the male rather ample and reaching the tip of the abdomen, those of the female covering but half of the abdomen, the dorsal members in the latter sex straight to the tip; wings wanting. Hind legs dull testaceous, the tibial spines pale near the tip. Cerci varying from testaceous to brownish, very slender, as long as the abdomen; ovipositor castaneous, a little upcurved, moderately stout, shorter than the hind tibiæ, the apical denticulate field longer than usual and nearly equalling one fourth the entire length of the ovipositor. Length of body, ♂, 7.3 mm., ♀, 9.4 mm.; of antennæ, ♂, 15.5 mm., ♀, 16.5 mm.; of tegmina, ♂, 4.2 mm., ♀, 4 mm.; of hind tibiæ, ♂, 4.1 mm., ♂, 4.5 mm.; of cerci, ♀, 4 mm., ♀, 5.6 mm.; of ovipositor, ♀, 3.8 mm.

North Carolina. This species appears to be nearly allied to Saussure's *N. toltecus* from Mexico; it is slightly smaller than *N. vittatus*, and of a similar appearance, but the males have larger tegmina, and the females longer ovipositors.

Nemobius volaticus. Head rather full and convex, projecting above the surface of the pronotum, black, with bristly hairs as in the preceding species; antennæ dark brown, with pale incisures; palpi varying irregularly from pallid to dusky, the terminal joint nearly twice as long as the third, and about three times longer than the fourth. Pronotum black, broader than long, slightly broader behind than in front, the anterior half or more with a distinct median furrow, the whole surface with scattered black bristles. Tegmina narrow, nearly as long as the abdomen, piceous, the interspaces between the nervures more or less testaceous, especially in the female, the nervules of the dorsal surface in the latter straight; wings very long, the tip of the closed tegmina lying midway between the tip of the wings and the front of the head. Legs testaceous, more or less infuscated, especially above, the hind femora rather slender, the tibial spines slightly paler at tip. Cerci slender, dusky, about as long as the hind tibiæ; ovipositor very much as in the preceding species castaneous, similarly armed at tip. Length of body, ♂, 7.25 mm., ♀, 6.75 mm.; of antennæ, ♂, 13 mm., ♀, 14 mm.; of tegmina, ♂, 4 mm., ♀, 4.4 mm.; of wings (closed), ♂, 8.5 mm., ♀, 8.5 mm.; of hind tibiæ, ♂, 3.75 mm., ♀, 3 mm.; of cerci, ♂, 4 mm., ♀, 4.25 mm.; of ovipositor, ♀, 3 mm.

Georgia. This slender species is doubtless nearly allied to *N. cubensis* Sauss., with which it agrees very well in size; the tegmina however are longer, the head is decidedly more convex, and the last palpal joint is comparatively longer.

Nemobius socius. Head castaneous, heavily striped with straight longitudinal black bands, and covered with moderately short black bristles, abundant only in front; it is rather full and convex, rising considerably above the level of the pronotum; antennæ castaneous at base, dusky beyond, deepening to blackish brown apically. Pronotum blackish, both upper and lower borders of the deflected lobes marked with luteo-castaneous, the surface sparsely covered with rather short black bristles as on the head, the anterior half with a distinct median furrow. Tegmina (♀) shining black, the tip, the common margin of the dorsal and lateral fields and the inner border more or less castaneous; they are as long as the body, and the nervules of the dorsal field, or at least the outer ones, curve inward strongly at the well rounded tip. Legs fusco-castaneous, the upper half of the hind femora darker than the rest. Cerci nearly as long as the hind tibiæ; ovipositor as long as the hind femora, the apical field as in *N. vittatus*. ♀. Length of body, 9.5 mm.; of antennæ, 11 mm.; of tegmina, 6 mm.; of hind tibiæ, 5 mm.; of ovipositor, 6.25 mm.

Georgia. This species is nearly allied to our common *N. vittatus*, with which it agrees in size, although a little slenderer; the tegmina however are much longer, and the ovipositor proportionally a little shorter.

Hadenœcus puteanus. Dark fuliginous brown, slightly tinged with castaneous. Head and under surface of body dull luteous; antennæ luteo-fuscous, darkest on the basal half; palpi slightly infuscated beyond the base. Upper surface of thorax and abdomen sparsely covered with excessively short hairs, giving it a punctulate appearance. All the femora and tibiæ brownish fuscous, the base of the femora and the extreme tips of the tibiæ a little paler; tarsi, as well as the longer tibial spines, pale luteous. Cerci brownish luteous; ovipositor testaceo-luteous, slender, not very long, in the apical half gently tapering, the tip upcurved, finely pointed. Length, ♂, 11 mm., ♀, 17 mm.; of antennæ, ♂, 60 mm., ♀, 80 mm.; of maxillary palpi, ♂, 7 mm., ♀, 9.5 mm.; of hind tibiæ, ♂, 18 mm., ♀, 20.5 mm.; of cerci, ♂, 4.6 mm., ♀, 5 mm.; of ovipositor, ♀, 7.75 mm.

This insect, found in North Carolina by Mr. H. K. Morrison, under boards covering an old well about forty feet deep, and on the wooded sides of the same, near the top, is one of the most interesting insects recently discovered in the country, from its close affinity to *Had. cavernarum* (*Rhaph. cavernarum* Sauss; *Had. subterraneus* Scudd.), which inhabits the Mammoth Cave of Kentucky. I shall take an early occasion to discuss the relation of these two species to each other and their allies, and will only mention here that the present species has several points of structure in which it approaches the allied genus Ceuthophilus. I have before received the species, in poor condition, from the Smithsonian Institution, collected by Miss Helen Jennison at Monticello, Mississippi.

Aegipan (*Αἰγίπαν*) nov. gen.

Slender, with long appendages. Head not very large nor full, the front nearly flat, the sides somewhat compressed, the posterior border bluntly but distinctly marginate; fastigium broad posteriorly, narrowing anteriorly, moderately prominent, with a distinct fusiform sulcation; eyes vertically obovate, twice as long as broad, prominent; antennæ very long and moderately slender, with the basal joint appressed, about twice as long as broad; second, cylindrical, smaller, tapering a little, considerably longer than broad; third, slender, cylindrical, as long as the first; the remaining joints subequal; apical joint of maxillary palpi nearly as long as the third and fourth joints together, thickened at tip and covered sparsely with short erect hairs. Pronotum subselliform, smooth, with a scarcely raised median line, the front border transverse, scarcely produced behind the eyes, the hind border almost rectangular, produced and more or less rounded, the humeral sinus slight; deflected lobes declivant, much longer than broad, barely reaching the lower edge of the epimera, the front and lower borders meeting at rather more than a right angle; prosternum unarmed; meso- and metasternum with small rounded posterior lobes. Tegmina long and slender, extending far beyond the end of the body, the costal margin distinctly expanded on the basal fifth or less, increasing slightly in breadth apically, the tip narrowing and rounded; wings almost half as long again as the tegmina, reaching as far backward as the tips of the femora. Legs exceedingly long and slender, the hind femora very slightly thickened; all the coxæ with an inferior, the anterior coxæ also with a superior spine; under surface of all the femora with a row of exceedingly delicate distant spines; fore femora nearly twice as long as head and pronotum together; geniculations of hind pair apically denticulate on either side; all the tibiæ sulcate externally, the foramina of the front pair elliptical, about three times as long as broad; hind tibiæ equal throughout, much longer than the femora, furnished beneath with, two apical spines; second joint of all the tarsi apically bidenticulate above. Abdomen compressed, with a median ridge on the basal half; subgenital plate of male apically bidentate, destitute of styles; ovipositor of female very short and broad, upturned, strongly compressed, very bluntly pointed.

The excessive length of the legs gives this genus a very peculiar appearance. It is allied to *Acrometopa* Fieb.

Aegipan grallator. Green. A faint pinkish stripe behind the top of the eye, crossed longitudinally by a slightly curving, tapering, white line. Anterior lobe of pronotum with an oblique white line on either side marking a ridge, approximating posteriorly, often bordered above with pink; posterior border of pronotum edged rather broadly on the deflected lobes, narrowly above, with white, everywhere delicately margined with pink. Limitation of the anal and median field of tegmina marked with dull pink; the hind femora often, and occasionally the other femora tinged, excepting at the extremities, with pink. Abdomen with a faint whitish lateral line, bordered distinctly below, faintly and narrowly above, with pink. The tympanum of the male tegmina as long as the pronotum. Inner margins of the apical denticles of the subgenital plate meeting at the middle of its apex; ovipositor of female green, pinkish apically at the edges, considerably longer than broad, externally scabrous with raised points directed apically, the edges serrate, with small but stout serrations. Length of body, ♂, 16.5 mm., ♀, 18.5 mm.; of antennæ, ♂, 56 mm., ♀, 60 mm.; of tegmina, ♂, 23 mm., ♀, 26.25 mm.; of wings, ♂, 32.75 mm., ♀, 34.5 mm.; of hind tibiæ, ♂, 37 mm., ♀, 39 mm.; of ovipositor, ♀, 4.2 mm.

Texas; frequently attracted to the light from May to August. G. W. Belfrage; also collected by J. Boll, June 13 to 26.

Aegipan phalangium. Very similar to *A. grallator* with precisely similar markings, excepting that the abdomen appears to lack the lateral stripe; the tegmina, wings and legs, are distinctly longer; the tympanum of the male tegmina is shorter than the pronotum; the male cerci are stouter, and the subgenital plate is squarely docked at tip, the base of the apical denticles being widely separated; the ovipositor of the female is formed as in *A. grallator*, but is broader, being scarcely longer than broad. Length of body, ♂, 15.5 mm., ♀, 19 mm.; of antennæ, ♂, 68 mm., ♀, 61 mm.; of tegmina, ♂, 29 mm., ♀, 30.5 mm.; of wings, ♂, 36.5 mm., ♀, 37.5 mm.; of hind tibiæ, ♂, 41 mm., ♀, 41.5 mm.; of ovipositor, ♀, 5.2 mm.

A few specimens were taken in Georgia by H. K. Morrison.

Caloptenus clypeatus. Brownish testaceous. Front of head varying from dull luteous to dull reddish brown, faintly dotted with fuscous; tips of mandibles and lower edge of labrum marked with black; antennæ luteous, infuscated on the apical third. Top of head and pronotum dotted faintly with fuscous, the deflected lobes of the latter paler, marked next the lateral carinæ with a black streak, which narrows and disappears posteriorly, broadens anteriorly, and extends slightly upon the head. Tegmina a little shorter than the body, the costal field dark testaceous, the central field blackish, and the anal field light testaceous or wood brown. Front and middle legs of the color of the body; hind femora blackish on their outer face (the inferior outer carina yellow), black interrupted with luteo-testaceous on the inner face, beneath vinous red; hind tibiæ varying from vinous to coral red, the spines black. Vertex between the eyes a little (♂) or much (♀) broader than the basal antennal joint, very slightly depressed centrally, at least in the male; frontal costa broad, subequal, slightly depressed at the ocellus. Pronotum scarcely enlarging posteriorly, even, with but slight transverse incisions and a slight median carina, equal in the female, interrupted slightly in the middle third in the male; lateral carinæ indistinct, rounded. Tegmina bent rather distinctly between the middle and anal fields; wings reaching the tip of the closed tegmina. Hind femora long, but moderately stout. Abdomen of male considerably thickened at the tip, forming a subglobose mass; supra-anal plate of same sex shield-shaped, being triangularly produced at the extreme tip, narrowly aud deeply sulcate down the middle; anal cerci of male stout, compressed, constricted in the middle, beyond incurved, expanded, especially above, the posterior edge much compressed, convex in the middle half. Length of body, ♂, 28.5 mm., ♀, 36 mm.; of antennæ, ♂, 15 mm., ♀, 14.5 mm.; of tegmina, ♂, 17 mm., ♀, 18.5 mm.; of hind femora, ♂, 17 mm., ♀, 21 mm.

Georgia.

Report on the Diptera brought Home by Dr. Bessels from the Arctic Voyage of the "Polaris," in 1872. By C. R. Osten Sacken.

The small collection of Diptera from Polaris Bay sent to me for examination, consisted:

A. Of seven vials of alcoholic specimens, containing:

1. *Chironomus*, numerous specimens of a small species.

2. *Scatella*, a species with the hyaline dots on the wings arranged like the North American *S. favillacea* Lw., or the European *sorbillans* Hal., but different from both.

3, 4, 5. Several specimens of *Anthomyia*, undistinguishable.

6. Puparium of a Muscid.

7. Larva of a Tipulid.

B. Of bottles 8 and 9, without alcohol, containing well preserved specimens of the Tipulæ, to be described below, one in each; also a specimen of *Trichocera* (*regelationis*?).

C. A few pinned specimens of the same *Tipulæ*, one species of *Anthomyia* and one *Lucilia*.

The Diptera from Greenland have been described several times; by O. Fabricius in the last century, by Stæger, Curtis, Zetterstedt and Loew in the present one. Schiödte, in his chapter on the Arthropoda of Greenland (in Rink's work), compiled nearly all that was known on the subject. Still the collection before me, small as it is, affords an exceptional interest on account of the very high latitude where it was formed.

The most interesting specimens in this collection are the two *Tipulæ*, the more so as they are represented in several well preserved examples. The pinned specimens of *Anthomyia* and *Lucilia*, as well as the above mentioned *Scatella*, in order to be determined specifically, should be compared with European specimens which are not within my reach. The alcoholic specimens cannot well be determined beyond the genus.

Of the two *Tipulidæ* one is a new species, dedicated to the discoverer. The other is a species described by Zetterstedt, from specimens also received from Greenland.

Tipula Besselsi n. sp.

Gray, thorax and abdomen with darker stripes; wings with a dark brown stigma; antennæ altogether black; ovipositor of the ♀ exceedingly short. Long. corp., ♂, 9—10 millim.; ♀, 12—13 millim.; long. alæ, ♂, 12—14 millim.; ♀, 15—16 millim.

Head dark gray, with a darker stripe over front and vertex; rostrum blackish, except the projecting labella, which are paler; palpi black; antennæ black, first joint with a grayish bloom; joints of the flagellum incrassate at their basis and verticillate upon the incrassation (the latter is stronger in the male than in the female); stretched backwards, the antennæ hardly reach the root of the wings; the joints of the flagellum are about equal in length, except the first, which is a little longer, and the last, which is a little shorter than the rest. Thorax dark gray; a cuneiform blackish stripe, divided by a longitudinal gray line, in the middle of the dorsum; lateral stripes visible, but less well defined; long, pale, erect, soft hairs clothe the intervals of the stripes, the sides of the dorsum, a portion of the pleuræ, the coxæ, the whole head, including the rostrum and the basal joint of the antennæ. Halteres brownish, basis of the knobs paler. Abdomen dull gray, with a longitudinal brownish stripe above; a similar stripe on the venter (the latter stripe is more distinct in the ♀ than in the ♂ specimens). Tip of the abdomen blackish, but very little incrassated in the ♂; of the four foliaceous appendages of the ♂ genitals the upper ones are brown, the lower ones paler. The valves of the ovipositor of the ♀ are exceedingly small (not more than three quarters of a millimeter long). Coxæ gray; their second joint more blackish; feet dark brown or black, basal half of the femora reddish-brown; the middle of the tibiæ also shows a trace of this coloring. Wings immaculate, with a whitish tinge (in some specimens with a slight brownish tinge on the apical portion); veins strong, brown; stigma elliptical, brown; petiole of the second posterior cell of moderate length.

Hab. Polaris Bay, Greenland; July 7, 1872. (Dr. Bessels.)

The short appendages of the ovipositor of the female, the coloring of the wings, etc., readily distinguish this species. The only species, so far as I can see, which can be compared to it, is *Tipula subnodicornis* Zetterstedt. But the "stigma obsoletum," the unicolorous abdomen, and other characters, readily distinguish this species from *Tipula Besselsi.*

Tipula nodulicornis Zett.

Zetterstedt, *Insecta lapponica*, p. 841, 8.

Diptera Scandinaviæ, x, p. 3934, 17.

Stæger, Grœnland's Antliater, p. 355, 15.

The second Tipula which I found in Mr. Bessel's collection agrees quite well with *T. nodulicornis* Zett. from Greenland. Unfortunately, only male specimens are at hand, and thus it could not be ascertained whether the ovipositor is serrated or not, as seems to be the case with that of Zetterstedt's species (compare the description in the *Insecta Lapponica*, which differs in some points from that in the *Dipt. Scandinaviæ*). Mr. Schiödte, in his article on the Articulata of Greenland, (in Rink's work; compare Berl. Entom. Zeitschr., 1859, p. 152) considers the *Tipula rivosa* of O. Fabricius (*non* Linné), *Tipula arctica* Curtis, Ins. Ross's Exp., and *Tipula nodulicornis* Zett. as synonyms. I am inclined to admit the synonymy of the first two species, but not that of the third. Curtis says of the abdomen: "the incisures slightly ochreous," and also indicates this coloring in the excellent figure he gives. O. Fabricius says: "mas differt abdomine magis testaceo." The abdomen of the specimens from Polaris Bay is of a uniform dull blackish gray. A comparison of Curtis's and Fabricius's descriptions reveals several other coincidences, but excludes the identification of the specimens which I have before me.

Note on "Die Gasteropoden Fauna Baikalsees."[1] By Wm. H. Dall.

This paper gives the result of an exhaustive examination of a large number of remarkable forms from Lake Baikal, one of which, *Choanomphalus*, had been generically separated by Gerstfeldt in 1859.

Of the other genera *Hydrobia*, *Ancylus*, and *Valvata* have long been established.

The new genera proposed are *Benedictia* Dybowski, for a mollusk with a limnæiform shell and rudimentary operculum, two species of which had been previously announced by Gerstfeldt and Schrenck as *Paludinæ*. One new species is described.

[1] Anatomisch und systematisch bearbeitet, von W. Dybowski (Dec. 1875) Mem. de l'Acad. Imp. des Sciences de St. Petersbourg, ser. VIII, t. XXII, No. 8 (cum tab. VIII, lith).

A genus *Limnorea* Dyb. is proposed, with two subgenera *Leucosia* and *Ligea* Dyb. ; for the first four new species are described and one referred by Gerstfeldt to the genus *Hydrobia* is added to them. To the second subgenus eight new species are referred. They appear to be allied to *Littorinella.* As not unfrequently occurs in memoirs where the author's attention has been chiefly devoted to anatomical details, the nomenclature and systematic relations appear to have been somewhat neglected. At least this is the most satisfactory manner of accounting for certain deficiencies to which this note is chiefly directed. The genus *Benedictia* appears to be well founded and homogeneous, but before it can be definitely accepted a careful comparison is necessary between the *Lioplacinæ* and the form referred to. *Lioplacodes* Meek (1864), offers some points of resemblance. This comparison is especially needed to test the validity of the author's proposal to make *Benedictia* the type of a new family allied more nearly to the *Hydrobiinæ* of Stimpson than to the *Viviparidæ*. This view is doubtful when the resemblance of the dentition of at least one of the species to that of *Lioplax* is noted, and in the absence of any figure of the operculum of *Benedictia*, which would seem by the description to be related to that of *Lioplax*.

The genus *Limnorea* is also proposed as type of a distinct family, whose validity it is not at present practicable to test in the absence of details in regard to apparently allied groups, which have been raised to generic significance by different authors within a few years.

The names adopted by the author unfortunately have been already preöccupied in Crustacea for many years in several cases, as has already been pointed out in a review of the memoir by Von Martens.[1]

Limnorea by Peron and Lesueur in Acalephs (1809), in Polyps by Lamoroux (in 1821), and by Leach and Dana in Crustacea.

Leucosia was used for a valid genus of Crustacea in 1798.

Ligea, under the form *Ligia*, is also preöccupied by Fabricius, and by Duponchel in Lepidoptera. These facts were recognized by Martens, who unfortunately did not observe that *Leucosia*, even if not preöccupied, would necessarily fall, from the fact that no subdivision had been left by Dybowski to receive the typical forms of his genus *Limnorea*, and who also neglected, as had the author he was reviewing, to mention any types of the several groups. Martens proposes for *Limnorea* the generic name *Baicalia* (*mel. Baikalia*) and for *Leu-*

[1] Jahrb. Deutsch. Malak. Ges. 1876. Heft. II, p. 181.

cosia and *Ligea* (which are respectively simply the smooth and sculptured forms of *Baikalia*) the names *Liobaicalia* and *Trachybaicalia*, respectively. His names are exactly synonymous with those of Dybowski, and no types being mentioned it is open to others to restrict the groups as their characters may seem to require.

The largest, first figured and first described species of *Benedictia* is *B. fragilis* Dyb. (l. c. p. 5, pl. I, f. 1 – 5), which may therefore stand as the type.

One or the other of the two names applied by Martens must be strictly synonymous with *Baikalia* as the typical subgenus. Naturally the most extensive of the two would be the one to be suppressed.

The subgenus *Trachybaikalia* chiefly differs from *Liobaikalia* by being ribbed, carinated or both. The genus *Baikalia* is in some of its members related to or more probably identical with *Tryonia* of Stimpson, from the typical species of which *B. contabulata* is hardly more than specifically distinguishable. *Prososthenia* Neumayr, is also very closely related, and but for its thickened lip might be considered identical with *Tryonia*. The singular resemblance of *Baikalia Stiedæ* to *Camptoceras* Benson, can hardly be more than analogical.

Two species of *Baikalia* present a feature which entitles them to sectional rank, namely *B. ciliata* and *Duthiersii*; whose ciliated epidermis strongly contrasts with the smoothness of the species associated with them by Dybowski. With this character are associated a more compact form and deeper sutures than most of the others exhibit.

The division of the genus by sculpture is hardly warrantable. The two groups fade insensibly into one another when tried by this test.

Similar transitions are noticeable among the original forms of *Tryonia*, which, like *Baikalia*, occupied an extensive inland lake, on the ancient beaches of which they are now found in immense numbers. With these are to be compared the numerous forms described from the Tertiaries of Central Europe by Brusina and Neumayr, before the generic place of the group can be definitely fixed.

The first species of *Trachybaikalia* (*Ligea*) mentioned by Dybowski, is *T. carinata*, (l. c. p. 45, pl. IV, f. 1 – 4). The adult shell is figured, contrary to the diagnosis, with a well marked anterior notch or canal. But for this I should consider it fully synonymous with *Tryonia*. The figure is possibly erroneous, but being without the means of determining this for the present it may be considered as the type of a distinct section. Otherwise, except in the case of *Liobai-*

kalia Stiedæ and those above mentioned, there do not seem to be any characters by which the group can be differentiated from *Tryonia*.

SCHEDULE.

Genus **Tryonia** Stimpson.

Type *T. clathrata* Stimpson, 1865.

Syn. *Leucosia* Dybowski, *ex parte*, *non* Fabr.

Ligea Dybowski, *ex parte*, *non* Fabr. *nec.* Duponc.

Limnorea Dybowski, *non* Peron and Lesueur, *nec* Lamoroux, Leach, Dana, *et cet.*

Baicalia Martens, Apr. 1876.

Liobaicalia Martens, *ex parte.*

Trachybaicalia Martens, *ex parte.*

SPECIES FROM LAKE BAIKAL.

Tryonia Godlewskii; *T. Florii*; *T. oviformis*; *T. carinocostata*; *T. turriformis*; *T. costata*; *T. Wrzesniowskii* (!); and *T. contabulata* Dybowski, sp.; *T. angarensis* Gerstfeldt, sp.

? Subgenus **Baikalia** Martens, *emend.*

Type *B. carinata* Dybowski, sp., *op. cit.* pl. IV. f. 1 – 4.

? Margin of the aperture notched anteriorly in the adult.

Subgenus, **Liobaikalia** Martens, *emend.*

Type *Liobaikalia Stiedæ* Dyb., sp., *op. cit.* pl. III, f. 20 – 23. Whorls loosely coiled, bearing a relationship to *Tryonia* analogous to that borne by *Lyogyrus* to *Valvata*, and *Camptoceras* to *Limnæa.*

? Subgenus **Dybowskia** Dall.

Type *Ligea ciliata* Dybowski, *op. cit.*, pl. III, f. 27 – 29.

Whorls transversely ribbed, with a ciliate epidermis, deep suture, short and rapidly tapering spire, and subcircular aperture.

If specifically distinct from the type, which seems doubtful, *Ligea Duthiersii* Dyb. also belongs to this section.

The first species of *Trachybaikalia* having been retained for the genus with which it was synonymous, while the name *Liobaikalia* would have been entirely inadvisable for this group even had it originally been included in that section, it appears that a new name is called for.

The remarkable character of the fauna of this lake basin will be found closely paralleled in the old Pliocene lake marls of both Europe and America. The creation of such a large number of generic groups as has marked the investigation of these lake-basins by Brusina, Neumayr, Meek, Stimpson and others, is likely, unless authors investigate closely the work of their predecessors in similar fields, to cause a great deal of confusion. It will be a great gain to science when every investigator recognizes it as his duty, not only to elucidate the physiological or anatomical features of a species, but to use at least ordinary care in giving its proper binomial designation, or failing in that, at least to refrain from adding to the already overwhelming mass of zoölogical synonymy.

Dr. W. G. Farlow made some remarks on certain algæ which were found, in August, 1876, in Horn Pond, Woburn, and which had caused a very disagreeable odor, resembling that of a pig-pen.

The principal species causing the trouble was so far decayed that it was impossible to determine it speeifically, but it seemed to belong to the genus Anabæna, and was perhaps related to *Nodularia litorea* Thuret, which produced at one time a similar odor at Deauville near Cherbourg. Another alga, *Plectonema Wollei* Farlow, vulgarly called eel-grass, was found at the same time, and also a quantity of *Clathrocystis æruginosa* Henfrey. The former plant is one of the Nostochineæ, and when it decays has also a pig-pen odor like that of the Anabæna previously mentioned. The Clathrocystis, known in Germany as the Wasserblüthe, is now considered to belong to the group of Bacteria, and is closely related to *Clathrocystis rosea-persicina* found on the decaying algæ of our sea shore.

Dr. Farlow then gave a short account of what is known of the development of Clathrocystis and some of the Bacteria and Nostochineæ, and described the peculiar effect which the species of Beggiatoa have in producing sulphurous odors.

General Meeting. December 20, 1876.

The President, Mr. T. T. Bouvé, in the chair. Forty persons present.

The following papers were read:—

Some Remarkable Gravel Ridges in the Merrimack Valley (Abstract). By George F. Wright.

A formation of gravel, known at Andover as "Indian Ridge," has long been familiar to the citizens, and has been remarked upon frequently by tourists and geologists. In the "Transactions of the Association of American Geologists and Naturalists," for 1841 and 1842, Pres. Edward Hitchcock, of Amherst College, gave a detailed account of the formation so far as then observed.[1] He there characterizes it as "decidedly the most interesting and instructive case [of the kind] which he had met with." A map of a mile and a half of it, then supposed to be its limit, was given by Prof. Hitchcock in the same paper, prepared by Prof. Alonzo Gray. This map, on a reduced scale, reappears in "Hitchcock's Elementary Geology."[2] Some other ridges of a similar nature were noticed by that eminent observer, and the suggestion was made by him that farther researches might show a system where now only a confused group was observed.

We could not improve upon the description of the main features of this formation given by Dr. Hitchcock, in 1842.

"Our moraines form ridges and hills of almost every possible shape. It is not common to find straight ridges for a considerable distance. But the most common and most remarkable aspect assumed by these elevations is that of a collection of tortuous ridges, and rounded, and even conical, hills with corresponding depressions between them. These depressions are not valleys, which might have been produced by running water, but mere holes, not unfrequently occupied by a pond."[3]

By reference to Plate 1, and the description here given in connection with it, the characteristics of this formation may easily be apprehended.

At Smith and Dove's Flax Mill, near Andover Depot, a dam raises the Shawshin River 14 feet. Measuring[4] from the river bed below the dam, the ascent to the peat bog, *o*, at the base of the east ridge is, in round numbers, 41 feet. Taking this bog as a level, the height of the successive ridges, East Ridge, Indian, and West, at the points *a*, *b*, and *c*, is 41 feet, 49 feet, and 71 feet. The point *c*, however, is in a characteristic depression of the ridge. On either side of it, north and south, prominences project 20 feet higher,

[1] See page 198.

[2] See page 260 (30th edition).

[3] Transactions of American Association of Geologists and Naturalists for 1841 and 1842, p. 191.

[4] The measurements were made under my superintendence by the class of 1875, Phillips Academy.

making them 91 feet above the base assumed at *o*, and 132 feet above the river. Branches not adequately indicated on the map run off at various points and form enclosed basins, which have no outlet except as channels have been cut through the loose material of the ridges, either by natural or artificial means.

Quite an extensive body of water was included, till long after the settlement of the town, in an enclosure between *b* and *c*. It has been drained, partly by a channel of its own formation, and partly by artificial means, and is now occupied by a muck swamp, which is 20 or 30 feet deep. A trigonometrical section of the West Ridge, at the point *c*, gives the height above the swamp at its base 61 feet, with a thickness of 250 feet. The slant is 30°. The river bottom from which we started is 50 feet above the ocean, so the extreme height of the West Ridge at the point of measurement is 182 feet. A few rods east of the point *o* there are irregular remnants of ridges of the same general character with the others, running southeast to the Shawshin, and east of the Shawshin there is a continuation with little interruption to the point *x*, where it is apparently pushed into a great number of irregular prominences enclosing numerous bowl-shaped basins; one of which, of oblong shape and about fifteen feet deep, is at the very summit, the rim of which rises to a height of about 100 feet above the river. The base of this part of the formation is on a level with the Shawshin, and hence about forty feet lower than those for which the measurements have been given upon the other side of the small river, the substratum of rock being that much higher in the one place than in the other.

A mile south, at Pomp's Pond, on the eastern side of the Shawshin valley, and partially connected by intervening ridges, is a similar cluster of rounded hills and enclosed basins, surmounted by a sharp peak of still greater height.

We should also observe, that clusters, or ganglions, of such irregular ridges, encircling bowl-like reservoirs, and rising into sharp peaks, occur at frequent intervals along the whole belt of the formation we are describing. Frequently, as a ridge is suddenly pushed up into a pinnacle, it will put out a spur, returning to itself and forming a closed basin at or near its top, as south of the point *c* on the map.

Before paying further attention to the course of the series north and south, I will describe its composition and structure. It is important to notice that the material in the ridges is not uniformly, nor every where stratified. The ridges themselves are ordinarily composed of sand, gravel and pebbles, the latter from a few inches to two feet through, sometimes irregularly stratified, the coarse material being as likely to abound near the top as at the bottom; at other times 10 or 15 feet or more in thickness will give no signs of stratification whatever. The top of the ridge is usually just wide enough for a foot path, and pebbles a foot or two in diameter dot its course at frequent intervals. Usually, also, the base of the ridge is partially hid by subsequent accumulation of stratified sand and fine gravel, or by peat bogs.

Another point of importance is, that the fragments of rock in the ridges are nearly all somewhat rounded and apparently water worn, though it is evident that they have not all been subjected to the same amount of attrition. I have searched in vain among the debris of the formation for scratched stones, though striated stones are found in abundance near the surface in the immediate vicinity. Furthermore, the pebbles are not of local origin. I am not sufficiently acquainted with the region to the north to determine the original locality of all of them. Merrimack slate abounds, however, as does a gneiss, with peculiar crystals of feldspar, whose "habitat" is well determined in central New Hampshire. In Topsfield a portion of the pebbles are clearly from ledges only a few miles to the northwest.

Keeping these characteristics in mind, we will now note the extent of the series so far as known. Between two and three years ago, and in ignorance of what Mr. Upham of the New Hampshire Geological Survey was doing, I began to prosecute investigations to determine more precisely the character and extent of the phenomena described. It was soon found that the system extended indefinitely along a line northwest by southeast, constituting a reticulated belt of gravel ridges a half mile or more wide, nearly coincident in general direction with the course of the striæ on the rocks, and with the line of prolongation of the axis of the Merrimack Valley from Manchester upwards.[1] The formation does not lie at a uniform altitude above the sea, but rises over hills and descends into river valleys in a certain apparent independence of the natural configuration of the country. The land, however, though undulating and somewhat broken, nowhere in this part of Massachusetts rises more than 300 or 400 feet above tide water. The ridges plainly belong to the superficial deposit, since they everywhere overlie the "boulder clay" or

[1] "Reticulated Ridges" is the happy descriptive phrase applied to the formation by Professor Shaler.

"till" of the region. Considerable difficulty, at first, attended the work of tracing the system, from the fact that spurs frequently run off from the main line and disappear. This occurrence is likely to deceive the inexperienced investigator into concluding that the whole series has terminated. Furthermore, extensive swamps and small lakes repeatedly occur in the reticulations of the series, while also the underbrush greatly impedes progress. Still again, for causes known and unknown, there are frequent interruptions of the series. Streams have cut through it. The Merrimack Valley crosses it nearly at right angles. Villages and cities have been built at various points along the course of the series, as at Ballard Vale, at Wakefield, Lawrence and Methuen, where men have been at work for a generation in removing the material for paving streets and ballasting railroads. Sometimes the ridges disappear in a sandy plain, in which case, however, there are usually bowl-shaped depressions in the plain along the line of general direction. This is noticeable east of Ballard Vale. It is quite possible that at other places the ridges are buried in a peat bog. Other interruptions may be accounted for by the unknown action of the currents of water which accompanied the disappearance of the continental glacier. I have now traced the course of the series which passes through Andover, south through Ballard Vale, past Foster's Pond and Martin's Pond, along the Town line between Wilmington and North Reading, across the Ipswich River two miles east of Wilmington, through the eastern part of Reading, and near the line between that town and Lynnfield to Wakefield, thence onward with more or less certainty to East Malden. Northward from Andover it crosses the Lowell and Lawrence Railroad, about a mile west of South Lawrence, and comes down to the intervale of the Merrimack, opposite the new water works. It is seen like a Chinese wall ascending the reservoir hill on the opposite side of the river. Thence it passes in unbroken line northward to Methuen. Scattered portions appear west of the Manchester and Lawrence Railroad, as far as Messer's Station.[1] The extreme distance between the points here mentioned is nearly thirty miles. But more decided indications in Methuen are seen farther west, northward from Crystal Pond, and still again, a half mile west of Salem Station,

[1] See Plates II and III. In Plate II the degree in which the ridges are independent of the river valleys is seen; also the relation of the series to the large rounded hills, as in Lawrence and Ballard Vale. In the latter place there is a typical expansion of a portion of the series into a plain with bowl-shaped depressions.

N. H. Again, west of the railroad, a mile south of, and also near, Derry Station, the phenomenon is well marked. The region between Salem, N. H., and Derry has not, however, been thoroughly investigated. Following the stream down from Derry Station, on the Manchester and Lawrence Railroad, to West Windham Station, on the Portsmouth and Nashua Railroad, the ridges are tolerably well developed for nearly the whole distance, especially near Mr. Campbell's, in Londonderry. That seems to be an unusual divergence from the ordinary course, and perhaps is unconnected with the main series. Again, the development is unmistakable for a mile or more near Wilson's Crossing, five miles from Manchester, on the Manchester and Lawrence Railroad. Mr. Warren Upham writes me that "an important series is plainly continuous from Loudon, along Suncook River to its mouth; thence along the west side of Merrimack River to a point opposite the south part of the city of Manchester, a distance of twenty miles." Mr. Upham's "opinion [of this series] is, that if farther traceable it would be along the Merrimack Valley to Nashua and southward," there being some remains of such a series visible four miles south of that place. I hope the region from Wilson's Crossing northward will be more fully explored; as it is not at all improbable that the series I have described will connect itself with that coming down from Loudon, making a line sixty miles long. I have been so often told that the ridge ended in a swamp about forty rods farther on, that I have become quite sceptical of negative testimony.

A year ago, in a paper read before the Essex Institute of Salem, I solicited information concerning any similar ridges in the vicinity. Rev. J. H. Fitts, of Topsfield, and Hon. Gyles Merrill, of North Haverhill, informed me of their existence in those towns. Largely through the assistance of these two gentlemen I have followed a series altogether like the one described, and running nearly parallel with it, and about seven miles distant, from a point one mile and a half north of Beverly Cove through Wenham, past the Gov. Bradstreet house in Topsfield, through the eastern part of Boxford (a branch seeming to come down from each side of Bald Pate Hill in Georgetown, one of which crosses the road between Georgetown and West Boxford, about two miles west of the former place), thence northwards to Groveland Station. Here the ridge continues across the broad intervale almost to the very bank of the Merrimack. On the opposite side of the river the ridge passes in a most singular manner over the eastern slope of a large rounded moraine hill coming down to the river road, two miles or more east of the centre of Haverhill, thence through East Haverhill, past the old Whittier house, thence, with occasionally less certainty, through Plaistow, N. H., East Hampstead, Sandown, Chester to Auburn past Mr. McDuffee's, and Eaton's Mills, near which the Portsmouth and Nashua Railroad shows a fine section of it. The whole distance of this series now traced is not far from forty miles. As much of these two series of ridges as lies in Massachusetts, is shown in Plate III.

Rev. W. E. C. Wright has partially investigated an intermediate series, shown also in Plate III. I transcribe his account:

"There is a well defined ridge like that in Andover to be seen in Danvers. The village of Tapleysville, and the section known as Dublin, near the crossing of the two railroads, are built on a portion of the ridge much extended to the right and left of the line of direction, the material being generally stratified. It forms the west bank, and the tongue of land on Otis Putnam's lower pond, and the east bank of his upper pond. From near the upper extremity of the upper pond the ridge may be traced, with some gaps, to Beaver Brook Station, near which it crosses both the brook and the railroad. Thence passing through the Lawrence place, it rises out of a large peat meadow back of the Wentworth place, and follows along the slope of a large lenticular moraine hill, nearly to the Newburyport turnpike. Crossing the turnpike near Nichols' brook, it throws out arms to the east, but its main line continues along the slope of another large moraine hill in the northeast corner of Middleton, producing for some distance the appearance of a gigantic raceway. Crossing the valley into Topsfield, it may be traced in broken sections a little behind the Johnson place, till it disappears among high ledges near an abandoned copper mine. It appears again in the right valley of the Ipswich River, half a mile below the Disputed Territory. A mile farther on, it has been found in two or three places this side of the saw-mill on Fish Brook, near where it is joined by the outlet of Crooked Pond. But this part has not been fully explored.

"The same line of direction extended from Danvers toward the sea will pass gravel ridges at Danversport, and a succession of them between Danversport and the Catholic Cemetery in Salem, and strike the cluster of rounded hills, curved ridges and enclosed basins in the cemetery in Marblehead, near the Forest Lead Mills, described by Dr. Hitchcock in 1842. As these similar phenomena thus appear in a line twelve miles long, in a direction coincident with the scratches on the rocks, and are absent both sides of that line, I cannot doubt their common origin. Between Danvers and the sea the ridges are near the sea level, and at several places sections show almost complete stratification. Above Beaver Brook Station the ground is higher, and the few places where I have found fresh sections show little or no stratification."

I will add here an account furnished me by Mr. Warren Upham of the New Hampshire Geological Survey, regarding other series of what he regards as similar ridges.

From the Saco River, at Conway, towards Ossipee Lake, along the railroad, and again southeast from Ossipee Lake, along Pine River, and past Pine River Pond and Balch Pond into Acton, Maine, there is a series which Mr. Upham has examined, and which he describes as essentially the same in character with the Merrimack and Andover series. Between Conway and Madison there is a wonderful exhibition of very extensive moraines, full of coarse angular boulders of all sizes, very abundant, with none of the modifying action of water, in ridges, etc., just like kames in arrangement. They occupy the side of the valley and pass by gradual transition to typical kames along the centre of the valley.

In the Connecticut Valley, Mr. Upham writes, that at Colebrook, 1050 feet above the sea, a single ridge is found on the east side of the river, one mile long, 25 to 75 feet high. It is parallel to the river, and runs north and south. Nothing else important of that description is found till Wells River is reached, where it is again well shown for one mile. Apparently it was once continuous, but has been cut through by the Connecticut and Wells Rivers. It is, there, in the middle of the valley, and reaches a height of 75–150 feet above the river, or 475–550 feet above the sea. No remnant is again found for more than twenty miles, when it appears again, and is plainly traceable for twenty-four miles from Lyme, N. H., to Windsor, Vt., occupying the middle of the valley, which is trough-like, being bounded by high ledgy hill ranges on each side. There the height varies from 100 to 250 feet above the river, or 500 to 600 feet above the sea. The fine alluvial silt of the high plains, by which this kame is sometimes almost covered to the top on both sides, and usually on one side, is shown by superposition, etc., to have been a later deposit.

South from Windsor to the Massachusetts line, distinct remnants are found every five to ten miles. Mr. Upham thinks it originally extended all the way south from Lyme, but does not think it was ever continuous above Lyme. A most noticeable point about this Connecticut Valley kame, Mr. Upham writes, is that it has no branches or parallel ridges, but extends in a very direct course in a single ridge along the bottom of the trough-like valley. It has been cut through by the now devious river seven or eight times. It is of sand and gravel, the latter predominating, in which the pebbles are mostly less than one foot in diameter, but sometimes one and one-half to two feet for the largest. No boulders, nor anything resembling "till," is seen in, or on the surface of the kame, except at one point, 225 feet above the river, 600 feet above the sea, where two five-foot boulders were found on its top.

Formations of a similar nature, under the name of "horsebacks," have been described by Professor C. H. Hitchcock, in various places in Maine.[1] Some of these are said to be forty miles long. Professor Agassiz's observations upon these phenomena in Maine, may be found in the Atlantic Monthly for June, 1864, and February and March, 1867. Mr. James Geikie's description of the "kames" in Scotland,[2] and the "åsar" in Sweden,[3] applies in the main to the phenomena we are considering.

A year ago, in a paper read before the Essex Institute,[4] in Salem, and when my observations had only taken in the series passing through Andover, I declined to theorize much until further facts had been gathered, but I stated provisionally what had been my working hypothesis, viz., that I was following up what might prove the remnants of a medial moraine in that portion of the continental glacier which took its local direction from the Merrimack Valley. The general direction corresponded with that of the scratches on the rocks, and the line when projected coincided nearly with the axis of the Merrimack Valley north of Manchester; leading up to the White and Franconia Mountains. Mr. Upham and Prof. C. H. Hitchcock have since directed my attention to the probable action of superficial currents of water during the progress of the melting of the glacier.

1 See Maine Agricultural Reports for 1861 and 1862.

2 See The Great Ice Age, 2d Ed., Chapter XXI, pp. 239 ff.

3 Ibid., pp. 408 ff.

4 See Bulletin of Essex Institute, Vol. VII, p. 165-168.

In partially accepting their views, I feel that I must modify, though not wholly abandon, my former opinion.

So far we have examined phenomena; let us now come down from the other direction and sée if we can find a cause that would reasonably produce the complicated series of facts we have presented.

At the height of the glacial epoch this region was covered with an ice sheet, say 5,000 feet thick. As this had slowly formed and moved southward, much earthy material had been incorporated into the frozen mass. Some had worked from below upward through the crevices, as the mass moved onward; far more had fallen upon it, after the manner familiar in ordinary lateral moraines, or been scraped off, and worked into it at various levels, from the sides of the mountains which it had passed and enveloped. The detritus would be peculiarly abundant in the glacier in the line of motion from the sides of mountains, like the Franconia Range, or the White Mountains, and would be found in the ice in a diagonal belt passing upwards from the base in a line parallel with the sloping side of the mountain, and would exist in the glacier in definite lines, corresponding to the direction of the general movement from the mountains southward.

When the climate began to ameliorate, so that the glacial sheet commenced to diminish, this diminution would take place in at least two directions; the southern boundary would retreat northward, and the thickness would diminish from the top. For example, there would be a time when the thickness had shrunk from 5,000 feet to 2,000 feet. If this had been mostly due to melting from the top, all the earthy material of the upper 3,000 feet would have accumulated on the top of the remaining portion of the glacier, after the manner of the dirt on a melting snow drift. In the lines of motion from the higher mountain prominences, there would of course be an excessive accumulation, forming a medial moraine. Now the material of this moraine would not settle down regularly and silently. But after a certain stage in the accumulation of debris, the ice would be protected under it so that it would have an additional elevation above the general melting mass, and as the melting progressed, the detritus would slide off the slopes on one side or the other. By the time fragments of rock had rubbed together in a lineal motion of many miles, and in a perpendicular descent of five thousand feet, they would be well worn. Pockets, and channels would be formed in the ice, where stratification of sand and gravel would take place. The material above would slide down upon them, or be washed rapidly down upon them in times of floods, which would account for the existence of such large unstratified masses above, and mingled with, stratified portions. During July and August the power of the sun's rays, united to the summer showers, would set free vast bodies of water which would, in part, escape along channels upon the surface of the glacier, and would pour forth a mighty volume from its foot. This would aid in moving the pebbles, and in transporting the material, and in modifying it when it was finally left by the retreating glacier to rest immediately upon the till, or ground moraine. In places, these currents of water might well remove it altogether, and it would be sufficient to fill the basins south of the glacier and upon temporary lakes, where stratified material would accumulate from the unstratified kame, and merge it in a plain; as, for example, at Ballard Vale; where the natural drainage is north. When, however, that was dammed up by the retreating ice wall, there would have been for some time, a broad, shallow lake, whose surface was even with the southern drainage level and whose bottom now constitutes the plain shown in Plate II.

Of the influence of these surface currents, Prof. Jamieson [1] has speculated, though with some degree of vagueness. He speaks of surface currents upon the glacier sweeping the sand and gravel into "lines along the margin." His idea, however, seems to be that it is the terminal margin, and that the kames are of the nature of terminal moraines, running across the valleys in the arc of a circle at right angles to their axes. Mr. James Geikie, however, in his second edition,[2] contends that the kames of Scotland run in a direction parallel with the general course of the valleys. This conforms to what is unquestionably the fact in the portions of New England which we have described. Mr. Geikie now speaks in more unqualified terms than in his first edition of the frequent unstratified character of the formation,[3] and accepts Mr. Jamieson's conclusions that the sea could not have had anything to do with their formation, since the angle of the inclination of the sides is much sharper than could be formed under water. He now attempts to account for them as the result of "subglacial rivers."[4] But among other things, the long extent of the

[1] See Quart. Journ. Geol. Society for 1874, p. 329.

[2] The Great Ice Age. 2d ed. London. Daldy, Isbister & Co. 1877. See p. 242.

[3] Ibid, p. 240.

[4] Ibid, pp. 239, 243, 469, 478.

series of ridges we have described, and their passage in many instances over large "lenticular" moraine hills, would forbid the application of such a theory here. Professor Agassiz thought those in Maine were formed in some way under the glacial sheet by the irregular pressure of the icy mass. But the absence of scratched stones is conclusive against that theory.

The large "lenticular" (lens-shaped) hills, of which Prospect Hill in Andover, Brown's Folly in Danvers, Pingree's Hill in Topsfield, Bald-pate Hill in Georgetown, Golden Hill in Haverhill, and the islands in Boston harbor, are typical, abound in Essex County, Mass., and in Rockingham County, N. H., and to a less degree farther inland. These are marked wherever they are known to occur in the space included in Plate III. They are, as will be perceived, conspicuous for their absence in various places. Without doubt, these remarkable hills, though ranging from 200 to 300 feet in height, belong to the "till," or ground moraine; for the pebbles and boulders in them are scratched, and are mingled with clay which is densely packed, and without stratification. These peculiarities were well seen in the construction of the Lawrence reservoir, which is situated near the top of such a hill, upon which the Andover series of ridges rested as a superficial deposit, and at a height of about 160 feet above the intervale on the Merrimack River, at that point. A fact which I had observed, but was unable to account for, is thus explained to me by Mr. Upham. He however gives credit to Professor Torell [1] for the idea that the dark (usually blue) color of the lower members of the "till," was due to seclusion from the air. The interior portion of these "lenticular" hills is of a dark blue or gray color; while with tolerable uniformity, for a depth of fifteen or twenty feet, so Prof. Hitchcock and Mr. Upham inform me, the material is of a reddish hue, and to this depth the stones are usually more angular and less worn than below. Why these hills should assume the shape that characterizes them, is more than I can surmise. But on the supposition that they were formed under the glacier, the present covering of less rounded and more oxidized material, is easily accounted for. This material was precipitated upon

[1] See abstract of paper read at the Buffalo Meeting of the American Association, 1876, on "Glacial Phenomena in North America," by Otto Torell, published in New York Times, and in Am. Jour. Science and Arts for January, 1877.

them from the melting ice sheet, after the analogy of snow from the atmosphere, or silt from water. The seclusion of the air from the mass below, prevented its oxidation, and preserved its original color, while that precipitated from the ice, was long exposed to both air and moisture, and hence would have the red color produced by oxidation. As I have already proved, the belt of ridges just described was a part of the precipitation spoken of, for it passes over some of these hills.

In conclusion, I must express my desire to have this whole class of phenomena still more extensively and carefully studied. We could theorize more confidently if we were sure we had been over the whole ground. In working out the problem, we need to trace with more certainty the pebbles to their local origin; we need to know more about the relation of the series I have investigated to what is farther north, and should also look for other series besides those we have already found. We should also consider mathematically what effect the contour of the Merrimack Valley would have in giving local direction to the portion of the ice sheet included in it at the various stages of the glacial epoch. At the earlier and later stages the influence of it would be larger than at the period of greatest accumulation, even if, as Dana suggests, there would then have been both an upper and an under current. We should consider how much the direction of a moraine-bearing glacier would change to the eastward, when the barriers of the water shed to the east of Manchester were once passed.

I desire also to express my gratitude for the advice, and other service rendered me by the persons named in the body of this paper, and to add the name of Mr. G. W. W. Dove, who has kindly prepared the maps for me, and aided in various other substantial ways.

Since the foregoing was in print, Mr. Clarence King has furnished me the following account of his observations upon the retreating glaciers of the Rocky Mountains. His observations are so direct, and the phenomena he describes are so similar to those connected with the ridges I have been investigating, that I cannot doubt he has hit upon the solution of the vexed and long mooted problem concerning the formation of "kames." Indeed, it would seem that he had, with his own eyes, seen them formed in such manner that the hypothesis of surface currents introduced by Upham and Hitchcock will hardly be necessary.

"During the glacial period, while so large a portion of the eastern and northern states was covered by a more or less continuous ice sheet, there were totally different conditions throughout the system of the Cordilleras. No northern ice-field stretched over that elevated region, and the only glaciers were local mountain streams descending from high centres of dispersion. The northern peaks of the Cascade and Sierra Nevada Ranges still hold in their glacial valleys, the shrunken relics of the old ice period. To the south, where the climate no longer permits great annual accumulations of snow, all the higher mountain ranges are scored by profound cañons, from 3,000 to 6,000 feet deep, whose forms were greatly modified, if not actually determined, by the system of extinct glaciers. Besides the ordinary topography of the *ciercs de névé* and the well known striated and polished rocks, (*roches moutonnées*,) dotted with huge erratics, there is a system of splendidly preserved lateral and terminal moraines ; the former traced along the flanks of the cañons wherever the angle of slope is sufficiently gentle to permit the accumulation of debris, and the latter stretched across the cañons at intervals, marking levels where glaciers temporarily rested in their general retrogression. The result is that all the great cañons of the Sierra Nevada have at intervals, for the upper thirty or forty miles of their descent, numerous piles of terminal debris, besides frequent long stretches of lateral moraines which have distinct ridge-like summits, as evenly graded as a railway embankment.

"During several summers I spent a great deal of time in the examination of these moraines, as well as of the erratics left in the bottoms of the glacial troughs. The valley erratics were of two kinds ; blocks of rock which had been transported on the surface of the glacier and which sunk to the solid bottom when the ice finally melted; the others are fragments which were embedded in the bottom of the glacier. The surface erratics are never striated and are usually of angular forms, such as may be observed to-day upon any Swiss glacier or upon the ice streams of northern California, Oregon and Washington Territory. The bottom debris, upon the contrary, is always sharply planed off on one side and evenly striated. The striæ often run in two directions, as if the blocks had been shifted in the ice and received a second set of groupings. The character of the blocks composing the lateral and terminal moraines differs altogether from both of these. Near the source of supply, high up on the flanks of the *nevés*, it consists altogether of angular or rudely rounded fragments ;

but after a few miles of grating and rolling along the sides of the glacier, the blocks are reduced to rude rounded forms, never showing any parallel striations; toward the ends of the longer lateral moraines, and especially the terminal moraines, most distant from the source of supply, the blocks are all rounded boulders, not differing greatly from those of a rapid mountain stream. Among these a great deal of gravel and sand has accumulated, and within the region dammed by terminal moraines subsequent glacial silts have become stratified in small pools and lakes.

"The process by which the lateral and terminal morainal blocks have been thus rounded may be readily studied upon the active glaciers of Mount Shasta. These no longer fill their former valleys, but are shrunken streams of ice which flow down the abrupt slope of the volcano's cone, enter the gorges worn by their ancestral glaciers, and are often walled in by abrupt precipices of volcanic rock from 800 to 1500 feet in height. The extremes of temperature are constantly cracking and dislodging blocks from the brink and flanks of these mountain walls, and as a consequence the glaciers are far more cumbered by debris than any that can be observed on the Alps.

"The case of the McCloud glacier, which I have mentioned in a chapter on Shasta flanks in *Mountaineering in the Sierra Nevada*, is especially interesting from the enormous cumbering piles of debris which overwhelm the lower stretches of the glacier and for at least a mile hide the ice from view.

"I had for some time supposed that the immense piles of rock which I had seen below the visible limits of the ice were of the nature of an ordinary terminal moraine and rested directly upon the bottom of the cañon, until I was attracted by a sudden grating and rushing sound in the middle of the region of debris and witnessed a very interesting phenomenon. The ice which underlaid the moraine blocks had evidently melted from the percolation of warm streams and the access of air through either *moulins* or *crevasses*. The rotten ice gave way under the load of debris and thousands of tons of rocks sunk down, leaving a conical pit a hundred yards in diameter and not less than a hundred feet deep. Along the brink in one or two places the ice showed through, but was rapidly covered by the avalanches of debris. A second subsidence of this character occurred while I was watching the glacier, and I at length discovered that from a mile to a mile and a half of the end of the ice stream was deeply buried beneath debris. These rocks had not been transported the whole length of the glacier, but had rained down from the cañon wall along the lower part of its course. Upon examination, however, they were all found to be more or less rounded, and many of them were quite rudely spherical.

"On the north-east side of Mount Shasta the glacial phenomena are on a larger scale. The main ice stream is two miles wide and ends in three distinct tongues, which project downward, occupying broad, shallow cañons. The ice for a long distance is covered with debris, exactly as in the case of the McCloud glacier, the sole difference being that the rocks have all been transported from the upper region of the cone, there being no flanking walls to supply the material along the glacier's lower course. As a consequence, the boulders have been far more jolted and tossed together, and are all rounded in the same manner as I have constantly observed the blocks of moraine piles of New England.

"I walked over these terminal moraines on the north-east side of Shasta and explored them very thoroughly. The general surface was thrown into rude hills three hundred or four hundred feet in height, and the conical depressions which I had already seen in process of formation on the McCloud glacier were dotted along at intervals over the whole terminal region. I was obliged to thread my way along the brinks of these moraine bowls, and in two instances with my companion actually started these subsidences. The blocks which are all more or less rounded, grated under our feet, an area from one hundred to one hundred and fifty feet wide began to sink, and we barely escaped going down with the heavy avalanches of boulders which poured into the middle of the pit as it constantly sunk deeper. It became at once evident that the rounding of the blocks was caused by the constant grating together of the whole morainal material. Reference to photographs of Bourne and Shepperd of Simla, India, shows several of the terminal regions of Himalayan glaciers, notably those along the Upper Ganges, where precisely the same phenomena are shown on a vastly grander scale.

"Not long after the visit to Shasta, together with Mr. Wm. Forbes and Mr. S. F. Emmons, I examined the island of Naushon, one of the Elizabeth Group, off Buzzard's Bay, Mass., which presented precisely the same phenomena I had been studying at Mount Shasta. The island is in my belief unquestionably a part of a terminal moraine which is partly on the main-land at Falmouth, the Elizabeth Group being its westward continuation. Naushon, which was the only island

I carefully examined, consists of piles of boulders, mostly rounded, tossed about in rude heaps, the chinks between them being pretty well filled with unstratified sand. The arrangement of the ridges of boulders, with their convexities always to the south, or away from the source of supply, together with the characteristic conical depressions, left me in no doubt as to the origin of the island.

"Martha's Vineyard, although cumbered with terminal rubbish, is based upon the inclined tertiary clays which crop out from Gay Head all along the north shore of the island. A considerable part of the area is covered with glacial material; but from the cursory view obtained by sailing along its shores and landing only once, I saw nothing like the true arrangement of moraine ridges. It seemed a confused mass of glacial rubbish, as if the ice had not rested long enough in one place to mark its termination by a true morainal wall.

"So far as I have studied extinct glaciers, wherever the terminal and lateral material have been pushed along to any great distance, the blocks are all more or less rounded. It is only the glacial tables or blocks which are transported upon the surface of the ice that retain their angular form."

Lenticular Hills of Glacial Drift. By C. H. Hitchcock.

The glacial drift, or *till*, composed of earth and glaciated or angular boulders of various sizes, frequently up to ten feet in diameter, indiscriminately mixed, without any of the assorting or stratifying action of water, is very unequally distributed over southern and eastern New Hampshire and eastern Massachusetts. Over large areas scarcely any considerable accumulations of this till are found, and ledges lie everywhere at or near the surface. Elsewhere the till occurs in large amount, covering the ledges, which are scarcely exposed over some whole townships near the coast. This till may be of irregular thickness and distribution; but generally, where it is found plentifully, it is to a large extent massed in peculiar, oblong or nearly round hills, which usually have quite steep sides and gently sloping, rounded tops, the whole presenting a very smooth and regular contour. Their outlines as protracted upon a map are lenticular in shape, whence their name.

These hills are of all sizes up to one third or one half mile long, with two thirds as great width, or they are sometimes nearly round. In a few cases they are prolonged considerably beyond their usual form. The most notable example of this which has been observed in our explorations is "Brown's Folly" or Folly hill, a N. W.–S. E. ridge, one mile long, in the west part of Beverly. The height of these hills varies from forty or fifty feet to one hundred and fifty or two hundred feet above the valleys which separate them, so that they are lenticular masses of glacial drift, or till, fifty to two hundred feet in height, placed here and there, and in many sections very thickly, over the country.

The material of these hills should be more particularly described as composed of two kinds of till, quite distinct from each other and separated by a definite line, not by gradual transition. The upper member is four or five to fifteen or twenty feet, or sometimes more, in thickness, of comparatively loose, yellow or reddish earth with boulders, which are frequently of large size, some of them glaciated but many of them angular and wholly unworn and derived from ledges near by; the lower member is a very compact, usually blue, stony clay, commonly without large boulders, but with rock-fragments usually abundant up to one or sometimes two feet in size, nearly all of which are glaciated and derived from ledges many miles distant. It will be seen that the upper member is the one almost invariably exposed to view, and this is usually the only one present where only a thin covering of till is found. This material seems to be the contents of the great ice-sheet at the time of its final melting, by which it was permitted to fall loosely upon the surface, the yellow or reddish color arising from change in the iron oxyd under the action of the air. Pressure under the great weight of ice, and seclusion from the air, have caused the very hard and compact character and blue or dark color of the lower member of the till, which is the true *ground-moraine*. The first of these distinguishing features has caused this portion of the till to be significantly denominated "hard-pan." This constitutes the principal mass of the lenticular hills.

These hills occur abundantly and conspicuously from Beverly and Danvers through New Hampshire into Maine in a belt ten to fifteen miles wide, near the coast. Inland they are at some places numerous and very well marked, as in Mason, Greenville, New Ipswich, etc., where they occur at heights from nine hundred to eleven hundred feet above the sea. They also occur at East Wilton, and at Ayer, Bernardston and Amherst, Mass.; but, in general, over the interior portion of New England these hills are not very frequent.

They are conspicuously absent from the immediate sea-shore for a width of two to five miles all across New Hampshire and south through Newburyport, but Boar's Head in Hampton is an exception, and in Ipswich, Mass., they extend quite to the shore. They are also notably absent from Cape Ann, which east of Essex river and Beverly has very scanty glacial drift in any form. The same is true south and southeast of Salem, where over a large section no glacial drift has been left to cover the naked striated ledges. Southward these hills occur again at Chelsea and Boston, where they form many of the islands of the harbor and the principal hills of Boston and Charlestown.

Along the seaboard they are often as thickly set as possible over the otherwise level country; not, however, resting one upon the side of another, but separated from each other by valleys, which reach down nearly or quite to the rock-strata. The longer axis of these hills is prevailingly N. W.–S. E., or nearly so; — that is, within limits of W. N. W. and N. N. W. This is everywhere the *prevailing* course, but there are important exceptions, especially south of Merrimack river. A singular uniformity of W. N. W.–E. S. E. course occurs in East Kingston, Kensington, and South Hampton, and farther northward in New Hampshire and Maine. About New Boston and Greenville, there is much uniformity of a nearly N. and S. course. At Bernardston the direction is a little west of south. Besides this trend of the separate hills, we often find them arranged one succeeding another in a N. W.–S. E. series, traceable for several miles. This is quite notably the case in Kensington and South Hampton, where the trend of separate hills is W. N. W.–E. S. E., each in succession being situated a little south of the one preceding, thus forming together a N. W.–S. E. series.

Inland, as about Greenville, these lenticular hills, of exactly the same form and character as those of the nearly level seaboard, occur over areas which are broken by high ranges of ledgy hills. In these situations we find the glacial drift not only in isolated hills, but also in numerous lenticular masses upon the flanks of the higher ledgy ridges.

Typical and prominent examples of these lenticular hills of glacial drift in Massachusetts, are Beacon hill in Boston, Bunker hill in Charlestown, Brown's hill in Hamilton, Turner's, Turkey, and Town hills in Ipswich, Prospect hill in Rowley, Bald Pate hill in Georgetown, Prospect hill in Andover, Hazeltine and Dead hills in Bradford, Crane Neck and Archelaus hills in West Newbury, Bear hill in Methuen, Silver's, Golden, and Great hills in Haverhill, Bear and Whittier's hills in Amesbury, and Powow hill in Salisbury; in New Hampshire, Indian Ground and Chair hills in South Hampton, Morse hill in East Kingston, Moulton Ridge, Martin, and Horse hills in Kensington, Great hill at Hampton Falls, Rollins, Bunker, and Stratham hills in Stratham, and Garrison hill in Dover; also, Nobby hill in Mason, Campbell and Bellows hills in Greenville, and Jefts hill in New Ipswich; in Maine, Frost and Bartlett hills in Elliot, and Butler's and Great hills in South Berwick. Towns which are almost wholly covered with these hills are, in Massachusetts, North Andover, Bradford, Groveland, West Newbury, Haverhill and Amesbury; and in New Hampshire, South Hampton, Kensington and Stratham.

In addition to these specially named, are numerous examples in the towns of Medford, Malden, Everett, Revere, Chelsea, Winthrop, East Boston, Somerville, Cambridge, Watertown, Brighton, Newton, and Brookline. There is a line of them from Revere through Winthrop, Point Shirley, Deer Island, Lovell's, Gallop's and George's Islands to Hull. They are no less conspicuous in Plymouth County, Cape Cod, the Elizabeth Islands, and very notably the whole length of Long Island, N. Y.

In attempting to solve the origin of these hills, account should be taken of their abundance over a long area near and parallel with the coast, and also in certain localities far removed from the coast and one thousand feet above the sea; in the former situation upon a level country, and in the latter among high, irregular, ledgy hills. Adjoining these areas of abundant lenticular hills, are sections almost wholly destitute of any glacial drift, *e.g.*, Salem, while over the greater portion of our territory it occurs in irregular accumulations of limited extent, and not at all in these steep, smoothly rounded hills. There must be some significance in their prevailing N. W.–S. E. trend, and also in their occasional arrangement in a N. and S. series and west of south; and these seem probably to be due to the direction of motion of the great ice-sheet, which was approximately the same, in the same regions. In the lowlands of Scotland the till is described by Geikie as lying sometimes in lenticular masses, resembling the hills which we find in New England, but apparently less prominent. A more common contour of the Scottish till, in which it differs from our own, is in prolonged ridges, called "drums" or "sowbacks," extending in the same direction with the flow of the ice, which coincided with the course of the principal valleys. (Great Ice Age, Amer. ed., pp. 17 and 88.)

Mr. Geikie attributes these different forms of surface of the till to the "varying direction and unequal pressure of the ice-sheet." Prof. N. S. Shaler, in a memoir upon these hills of glacial drift about Boston, has suggested that they are remnants of erosion (Proc. Boston Soc. of Nat. Hist., Vol. XIII, p. 196). Alluding to the possibility of this, Mr. Geikie says, "This peculiar configuration of the till, although doubtless modified to some extent by rain and streams, yet was no doubt assumed under the ice-sheet."

As some of these lines of lenticular hills are ten miles long, and most of them on the seaboard are essentially parallel to one another, and adjacent regions destitute of them, we cannot doubt their origination from glacial movements. They are more like lateral moraines than any other drift accumulations, or they might be regarded as modifications of one great terminal moraine, reaching from Maine through New Hampshire, eastern Massachusetts, Cape Cod and Long Island to New York. Their marked absence from certain localities may indicate irregularities in the edge of the ice sheet.

The various features of these hills indicate different and successive movements. There must have been a planing down of the ledges prior to the accumulation of the moraines; perhaps the same with the glaciation of the districts where the lenticular hills are absent. And lastly, the distribution of loose blocks over their surface in the universal rounding of the hills, appears like the results of local movements connected with the final disappearance of the ice. A few cases of hard pan overlying thick deposits of sand remain to be explored.

These observations have been made for the New Hampshire Geological Survey, in which I have been greatly assisted by Warren Upham.

A fine bust of Prof. Louis Agassiz, by Mr. Preston Powers, the gift of the Rev. R. C. Waterston, was exhibited, and a vote of thanks to the donor passed.

A collection of Geodes from Iowa, the gift of Mr. H. S. Smith; a series of Porphyries from Mr. T. T. Bouvé; a collection of minerals and products of Queensland, from the Centennial Commission of the Province; and a work on the Mammals of Australia, from the Australian Commissioner, were exhibited, and the thanks of the Society voted to the several donors.

General Meeting. January 3, 1877.

The President, Mr. T. T. Bouvé, in the chair. Sixteen persons present.

The following papers were read: —

A Comparison of the Spiders of Europe and North America. By J. H. Emerton.

The material for a comparison of the spiders of Europe and America is yet small. In the central and western part of Europe probably all the common species are known, though the exact range of very few has been determined. In America, collections have been made at various places along the Atlantic coast, in Georgia, Alabama, Kentucky, Ohio, Illinois, Utah and California, the most complete local collections in the northern states containing about three hundred species, or nearly the number known in England and Sweden at the time of publication of Blackwall's Spiders of Great Britain and Westring's *Araneæ Suecicæ.* The larger and commoner species of the two countries are therefore probably known and may be fairly compared. The genus Argiope has in Europe *A. bruennichii* found only in the southern portion, in North America two species described by Hentz under the names *Epeira riparia* and *E. fasciata,* which are both abundant as far north as Massachusetts. The latter was supposed by Hentz to be identical with *A. bruennichii,* and indeed resembles it much in color and markings, but differs in size and in sexual characters.

The group to which belong *Epeira angulata* and *nordmanni* has in America numerous species, two, of which only young females have yet been found, being probably identical with the European species named. Several species, of which only young are known, approach *E. dromedaria* and *E. bicornis.*

Epeira diademata, the commonest of the Epeiridæ in Europe, and apparently the most liable to be exported, has not been found in America, nor is its place filled by any similar species. *Epeira insularis* Hentz was supposed from Hentz's description and figure to be *E. marmorata* of Europe; it differs but little from it. *E. trifolium*

Hentz approaches equally near to *E. quadrata*, some females being only distinguishable by differences in the epigynum.

Epeira displicata Hentz is related to *E. cucurbitina* and *E. westringii*, but is never colored green, but sometimes, especially in young individuals, red.

Epeira acalypha of Europe has two North American allies, *E. gibberosa* and *E. placida* Hentz.

Epeira carbonaria of the Alps is closely related to *E. packardii* of Labrador and the White Mountains.

Epeira sclopetaria and *E. palagiata* are equally common in both countries, but the latter seems to be more common about houses and less on bushes in America than in Europe. *E. cornuta* has not been found in America, but is replaced by *E. strix* Hentz, a species seldom living near houses. *E. umbratica* is not found in America.

Zilla x-notata and *Singa heerii* are both represented by very close allies, of which only females have been collected.

Meta menardi is found in caves and damp cellars in Europe, and also in the caves in Kentucky, Indiana and Virginia, and in Maine and Massachusetts. No species are found in America analogous to *M. segmentata* and *M. merianæ*.

Epeira conica = *E. caudata* Hentz is common in both countries.

Epeira spinea Hentz is found as far north as Massachusetts, but belongs to a southern group, Acrosoma, not found in Europe. *E. rugosa* and *E. mitrata* of Hentz belong to the same group, and are found as far north as Connecticut.

The genus Tetragnatha, represented in Europe by *T. extensa*, and several other species of uncertain limits, has in America numerous species as difficult to classify.

Linyphia marginata = *L. marmorata* Hentz, and *L. phrygiana* = *L. conferta* Hentz are common in both countries. *L. bucculenta* and *L. socialis* are occasionally found in America, and *L. hortensis* and *L. pusilla* are represented by allied species. The group to which belongs *L. crypticola* has numerous species in both countries. *Erigone viaria* is common to both. *Erigone atra* and *E. cristata* have been identified by Mr. Cambridge among American spiders.

Pachygnatha has in America *P. tristriata* Koch., allied to *P. clerckii*, but no species have been found resembling the European *P. listeri* and *P. degeerii*.

Eucharia bipunctata, a very common house spider in Europe, is represented in America by *Theridion boreale* Hentz, a species so nearly related that the females can hardly be distinguished from each other.

Lithyphantes corollatus and *Theridium stictum* are found near Boston.

Theridion tepidariorum, found in Europe only in plant houses, is one of the commonest house spiders in North America.

Ero variegata occurs in both countries.

Phillonethis lineata, a very common spider in Europe, has been found near the coast in Massachusetts.

Theridion sphærula Hentz, found in Massachusetts, has its nearest European relatives in Corsica.

The genus Theridion, including *T. pictum, T. varians,* etc., in Europe, has about the same number of species in America, but all different from the European.

Pholcus phalangioides and *Scytodes thoracica* are found in both countries.

Of the Thomisidæ, the genera Xysticus and Oxyptila are largely represented in both countries, but by different species, while in the genus Tibellus two species, *T. propinquus* and *T. oblongus,* are common to both countries.

Misumena vatia = *Thomisus fartus* Hentz is found in both countries, and has in both the same variations in color and markings.

The European *Ocyale mirabilis* is represented in America by *Micrommata carolinensis* Hentz, a species approaching nearer the genus Dolomedes.

The genus Oxyopes has several species in the southern United States, but is not found so far north in America as in Europe.

The Agelenidæ appear to be less numerous in species in America than Europe. *A. nævia* Hentz, the commonest American form, is very different from the common European species. *Tegenaria medicinalis* Hentz is allied to the European species of Tegenaria and Celotes. *T. derhamii* of Europe is found in cellars in America.

The genus Hahnia is well represented in America, but so far as compared, all the species differ from the European.

Amaurobius ferox is found in America, but thus far only in cellars of houses. *A. claustrarius* has been found on Mt. Washington.

Hyptiotes has in Europe *H. paradoxus,* in America *H. americanus* = *Cyllopodia cavata* Hentz. Ulobarus has in North Europe *U. walckenærius,* in North America *Phyllyra riparia* Hentz, which, however, is more allied to *U. plumipes* of the south of Europe.

Among the Attidæ, *Salticus scenicus*, *Attus falcatus*, *Attus fasciatus* and *Euophrys reticulatus*, are found in both countries.

The American species of Dendryphantes are numerous, and all appear to be different from European.

Two species of Phidippus, *Attus mystaceus* and *A. tripunctatus* Hentz, are among the commonest American Attidæ as far north as Massachusetts.

The American Lycosidæ and Drassidæ are yet hardly well known enough to be compared with the European. A common American Drassus is nearly related to *D. lapidicola*, though not identical with it, as stated in my list in "Psyche," of January, 1876. A Gnaphosa from New Hampshire appears to be *G. muscorum* of Europe. A common Phrurolithus is near *P. festivus*. *Herpyllus ater* Hentz is near *Melanophora petrensis*.

The only Dysdera yet found is hardly to be separated from *D. crocota*. *Pylarus bicolor* Hentz belongs to the genus Ariadne.

Argyroneta, which has the peculiar habit of living under water, has not been found in America.

We see from this list that the greater part of the known spiders in North America belong to the same genera as those of Northern Europe, and about one fourth to the same, or similar species. Of the latter, a large proportion belong to the smaller genera, as Ocyale, Tibellus, Eucharia and Hyptiotes, while such groups as Lycosa, Xysticus, Clubiona, Dictyna and Erigone, having large numbers of species in each country, have fewer species common to both.

The occurrence of several house spiders in both countries, leads to the suspicion that they have been carried by man from one to the other, as *Theridion tepidariarum* in Europe, and *Salticus scenicus*, *Amaurobius ferox* and *Pholcus phalangioides* in America. On the other hand, many of the commonest spiders appear never to be transported, as the European *Epeira diademata* and the American *Agelena nœvia*.

The peculiar distribution of two species can hardly be due to any recent cause, *Epeira packardii* and its relative *E. carbonaria* living on the White Mountains and the Alps, and *Meta menardi* living in caves in both countries.

A conspicuous difference between the two faunæ is the larger number of southern spiders which come north into a colder climate in America than Europe, as the genus Argyrodes, Argiope, *Theridion sphœrula*, *Epeira spinea* and *rugosa* and Phidippus. From the collections thus far made in the Southern States, it seems probable that all the groups in North America have a greater range north and south than the same groups in Europe.

Dr. H. Hagen made some remarks on the occurrence of White Ants in the West and North-west, and read the following communications made to him on this subject: —

EXTRACT FROM A LETTER BY BARON R. OSTEN SACKEN, ON THE SPECIMENS OF TERMES FOUND BY HIM IN CALIFORNIA.

Termopsis angusticollis was frequently observed by me in dead trunks and branches of *Quercus agrifolia*, near Santa Barbara, in February. The specimens in the bottle were taken from a small trunk or root, completely riddled by them. There were about half a dozen large-headed individuals, soldiers, in the colony; nearly all the other individuals looked like pupæ, and had rudimental wings. In a cavity at the foot of the trunk a number of wings were collected.[1] A few days after, having secured a considerable number of specimens from that trunk, I found a dry branch, which was filled with what I thought was the same kind of pupal specimens. I took only two of them, and kept them for some time alive. In examining them at home, I noticed that they had facetted eyes, that they were darker than the specimens of the other lot, and that what I had taken for rudiments of wings were *stumps* of wings, like those which remain after the shedding of the wings by the imago. In a word, I had imagos before me. I regretted now that I had not examined the branch more carefully, but I remembered that it was full of individuals of the same kind. It is not probable that Termites had been flying so early in the year. I conclude that they were last year's specimens, having wintered in their wingless state.

I saw this large species *flying* at Clark's Ranch, Mariposa Co., June 3, 4; in Yosemite a few days later (altitude of the valley 4000 feet). I suppose, therefore, that lower in the valley they fly much earlier. I saw them again about Lake Tahoe (6200 feet altitude), July 18. They were very numerous in the air about sunset. I observed a very large stump of *Pinus ponderosa* covered with specimens, which after alighting, got rid of their wings and were running

[1] These wings looked cobwebbed, mouldy and old, having evidently been shed long ago, probably last year.

about on the horizontal surface of the trunk, examining the crevices, but not attempting to descend into them. Torn off wings were lying in numbers on the trunk. On the previous day (July 17) I had seen the same species flying about at Summit, Sierra Nevada, altitude 7042 feet. I observed a pine trunk out of which they were emerging, a proof that they actually live and breed at that altitude. July 22, the same were flying about Webber Lake, 7000 feet altitude. I observed a couple of blue birds which had their nest on the verandah and fed their young with these Termites.

The smaller species of Termes I observed on the wing at the Geysers, Sonoma Co., May 6. Seeing the air filled with them about the hotel, I soon found a plank on the ground, from under which they were emerging, coming from under ground. As the spot was in the yard of the hotel, I could not well dig very deep in the soil. At the same time I noticed a number of individuals on the soil, which had already shed their wings and were running about in couples. One of the individuals forming those couples looked a little longer and more pubescent at the end of the abdomen than the other; thus inducing the belief that those were the two sexes. I watched these couples for some time, running one after the other, very sedulously, but I never saw them copulate. About this time I was called to dinner, and saw similar couples running about on the table-cloth. I secured several such couples, both in alcohol and on pins. I never saw the Termopsis run about in couples in that way.

At Manitou, Colorado, Aug. 19, I saw a small Termes flying (perhaps a different species), and observed similar, already wingless, couples on the ground. Some specimens are preserved in the collection.

Note by Dr. Hagen. The observation on *Termopsis* is interesting, as nothing is on record about it. This species gains an additional interest from the fact, that it is the only surviving species of a genus, of which several fossil species occur in amber and in different tertiary strata. It forms of itself a very distinct group among the Termitina. I have some larvæ from Central America which may belong to a different species.

The altitude at which this species was found (7–8000 feet) is also entirely new. We have no record of any species of Termes having been found even half so high.

The specimens of Termes from Sonoma County I cannot distinguish from the common *Termes flavipes* of the Atlantic States. This is very remarkable, as it has not been known to occur west of the Rocky Mountains; at least I have never seen similar specimens in any collection, nor any record of the fact.

Finally, the specimens from Manitou belong to a new species, which, singularly enough, comes nearest to the *Termes lucifugus* of Europe. Here again the altitude (6000 feet) is worthy of notice.

Letter from Mr. H. S. Treherne.

Poughkeepsie, N. Y., Dec. 26, 1876.

Dr. H. A. Hagen.

Sir: — Happening to look over the number of the "American Naturalist" for July, 1876, I noticed your paper on the "Probable Danger from White Ants," and I concluded to trouble you with a letter. The system of surveying and marking out lands in Manitoba and the Northwest Territories is similar, I believe, to that used in the Western States, namely — the land is laid out in blocks of a mile square. At each half mile a trench is dug and a mound raised, and in the centre of the mound a wooden post is planted, having about two feet in the ground and about two and a half feet above. As timber is very scarce, except small "bluffs" of poplar trees, upon the prairies these posts are generally made of poplar. Poplar wood is well known to be very soft and to dry very quickly.

Nearly every post that had been planted over a year, which I came to while upon some engineering work out there, I found to be what I at first considered very loosely sunk into the ground, but upon examination I found them eaten through and through by ants. At first I imagined that the nest was in the post, since so many tunnels and passages had been bored through it, but I never managed to find what I searched for, until I despaired of ever finding the "queen."

One day we set our teamsters to move camp, and pointed out upon a rough map the exact spot we wished the field commisariat officer to pitch the new camp. We did not arrive in camp until nearly dark, and too tired to look around us. The next morning, however, I noticed within two or three yards of my tent a small hillock, which was evidently an entrance to an ant's nest, since it was formed of small, dry, sandy knobs of earth, through which a very great number of small sticks, about an inch long and one-sixteenth of an inch in diameter, were scattered. For about three feet down these knobs and sticks were found, the nest seemed then to tend in a southerly direction. About a hundred feet away in the same direction as the nest tended was one of the posts and mounds mentioned previously. This mound was swarming with ants, and the post was riddled with their galleries, so I concluded that it was a part of the same nest.

The workers were whitish with yellow heads, and appeared to be blind. The winged ants were of a rich brown, with head blackish brown and brownish antennæ, wings very frail and white, and the lower part of legs and the tarsi yellow. I take them to be of the species *Termes flavipes* Kollar, but I thought it a rare thing for them to be found so far north, and I did not know they made nests in hillocks, and am consequently puzzled.

Not knowing how to describe entomological specimens at the time, I did not take a more minute description of these insects. Can you inform me whether it is customary, or even common, for these white ants to make such nests, or, from the meagre description, inform me to what species they belong.

I may as well say that I never found the "queen," although I came across thousands of eggs in different stages of maturity.

Is it possible to tell me from the following miserable description in my note-book of the workers, the name of the species: "The workers were nearly half an inch long, with a large head of a reddish color, with small, black eyes and large and strong nippers, a long, narrow thorax of a brown color tinged with red, and a large abdomen of a satiny black, with gray cross stripes." These ants had a number of small black ants working around the nest (perhaps *Termopsis occidentis* Walk.).

Hoping that, from among your multifarious cares of business, you can spare sufficient time to aid me in determining these species, I remain, Yours,

H. S. TREHERNE.

The deaths of Karl Ernst von Baer, an Honorary Member of the Society, and of Mr. F. B. Meek, of the Smithsonian Institution, a Corresponding Member, were announced.

Section of Botany. January 10, 1877.

Mr. T. T. Bouvé in the chair. Twenty persons present.

Dr. G. L. Goodale read the following note from Dr. Asa Gray on some remarkable specimens of *Kalmia latifolia.*

It is well known that this *Kalmia* attains its maximum size in the Southern Alleghanies. Probably nothing upon record exceeds, or even equals, the following measurements of the girth of two trees which grew, along with others not very much smaller, in the bottom of a dell back of Cæsar's Head, on the extreme western border of South Carolina. One trunk, at a foot or so from the ground, measured four feet one and one-fourth inches in circumference, and rising without division, maintained a size approaching this and gradually lessening, for six or seven feet. Another trunk measured three feet four inches in girth above the first limb or fork; below it, at nearly one foot from the ground, it measured four feet and four inches. The measurements were taken Sept. 2, 1876, by Dr. George Engelmann, Wm. M. Canby and Asa Gray.

General Meeting. January 17, 1877.

The President, Mr. T. T. Bouvé, in the chair. Thirty-one persons present.

Messrs. C. W. Kempton, Wm. M. Davis, Jr., C. W. Scudder, Wm. S. Bryant, Misses E. A. Chandler, and A. C. Taber were elected Associate Members.

Dr. David Hunt read a paper on the Closure of the First Branchial Cleft in the Mammalia, describing the development of the ear in the pig.

Dr. T. M. Brewer made some remarks on the eggs of *Molothrus bonariensis.*

The eggs of this parasitic bird are of several entirely different kinds in respect to form, size and color, being thus adapted to escape detection in the nests of the different birds on which the Molothrus is parasitic. Paintings of three kinds of eggs were exhibited.

Mr. J. H. Huntington showed and described a new machine for cutting and polishing rock sections.

The following resolutions on the death of Mr. F. B. Meek, a Corresponding Member of the Society, were offered by Mr. Hyatt, and adopted.

Resolved: That the members of this Society have heard with the deepest regret of the decease of one of the most highly esteemed of its Corresponding Members, Mr. F. B. Meek, of Washington.

Their admiration can add but little to his reputation, which is secured by the numerous works of which he has been the author.

They feel, however, that a testimonial is due from them to the memory of a man whose knowledge of the whole field of American Paleontology was unsurpassed; and whose life was a model of laborious special investigation, and therefore unrewarded by public commendation.

As students of Natural History, they desire also to record their respect for a life of such modest simplicity and devotion to science for its own sake, that it merits, and will, it is hoped, receive, the highest praise from the hands of Mr. Meek's fellow laborers.

Resolved: That this resolution be recorded in the Proceedings of this Society, and that copies be forwarded to the friends of the deceased.

Two specimens of the King Duck, shot and presented by Messrs. G. A. Kendall and S. H. Mackay, at Saughkennet Point, R. I., were shown, and the thanks of the Society were voted to the donors.

The following change in the Constitution, accepted by previous vote, was finally adopted, Art. IV, first clause, therefore reading: —

Corporate Members only shall be entitled to vote, to hold any office except that of Treasurer, or to transact business.

General Meeting. February 7, 1877.

The President, Mr. T. T. Bouvé, in the chair. Thirty-seven persons present.

Dr. W. G. Farlow read a paper, to be published in the Society's Memoirs, on our species of Gymnosporangium or "Cedar-apples," and their supposed relation with Rœstelia.

Mr. S. H. Scudder offered some remarks on the phenomena of Circulation in Insects, a subject upon which very contradictory views had been held.

The juices of the digested food appear to pass through the thin walls of the alimentary canal directly into the general cavity of the body; from here they are pumped into the hinder extremity of the pulsatory dorsal vessel by its alternate contraction and dilatation; certain portions appear also in many cases to enter the sides of the vessels, just in advance of the valves, which aid the pulsating action by allowing a free passage to the fluids only in a forward direction; in the larval state, the vascular walls of the pseudocardium are often so slight as scarcely to be perceptible; but they are distinct in the perfect stage, and as the vessel contracts toward the head of the larva its nature becomes more apparent. More than a century ago, Lyonet showed that the dorsal vessel of Cossus has only a single outlet for the passage of the fluids, namely, where it terminates with a flaring opening at the extreme front of the head, just above the base of the œsophagus, into a cavity closed by membrane. The direct passage of the fluids thence has never been observed, but they must in some way enter at once the peritrachean passages, since they are next found circulating in them all over the body. Other writers have described the anterior extremity as branching, but in like manner have not traced the passage of the fluids beyond the main trunk.

Mr. Scudder observed that the only large tracheal vessel connecting the two sides of the body, lay in the first segment behind the head; and that, according to the recent and little known studies of Barthélemy,[1] this transverse tracheal conduit appears at the earliest formation of the system in the embryo, before any regular distribution of fluids over the body can be observed ; from the middle line of this transverse trachea half a dozen or more prominent branches pass directly forward, and some at least of their branches penetrate the cavity into which the dorsal vessel empties its contents; it is therefore highly probable that through them the fluids enter the peritracheal system ; for by this channel the fluids would pass in the easiest possible manner to every part of the body, from the moment that the pulsations of the embryo commence. This, therefore, is the principal point toward which it is desirable that future investigation should be directed; and especially the structure of the tracheal threads which enter this cavity should be minutely studied.

The tracheæ, as shown by Dufour, Blanchard, Agassiz, Williams, Kunckel and others, consist of two entirely distinct parts ; but though these authors do not wholly agree in their explanation of the structure of the tracheæ, there appears to be little doubt that it is substantially as follows: first, a main stem and its branches, in which,

[1] Récherches d'Anatomie et de Physiologie générales sur la classe de Lépidoptères. 4°. Toulouse, 1864.

between investing tunics, lies a closely coiled spiral thread; and outside of and enveloping which is the peritracheal vessel, whose outer walls are not limited by the extent of the tracheæ proper, but extend beyond the spiral coil to form the second and distinct part of the system, — namely, capillary tubes, penetrating every portion and organ of the body, and terminating in a mesh-work of interlacing branches. In other words, this portion of the circulatory system consists of branching tubes, which enclose within all but their ultimate ramifications the similarly branching tubes of the respiratory system. The fluids, therefore, forced by the dorsal vessel into the peritracheal cavities, become thoroughly aerated before passing into the tissues of the body to perform their functions; when they have done their work they empty into the general cavity of the body, and mingling with the fluids newly expressed from the alimentary canal, join the general currents which, as first shown by Carus, appear to set, in regular channels at the sides and floor of the body, often, however, with no vascular boundaries, toward the hinder extremity of the body, or toward the sides of the dorsal vessel, to enter again the initial point of the circulation.

General Meeting. February 21, 1877.

The President, Mr. T. T. Bouvé, in the chair. Twenty-seven persons present.

Mr. C. S. Minot read a paper on the Classification of the Trematod worms, giving a particular account of the anatomy of *Distoma crassicolle*, parasitic on the European Salamandra.

Mr. S. H. Scudder made some remarks on the metamorphoses of insects.

Mr. Charles W. Scudder was elected Treasurer.

The thanks of the Society were voted to Mr. Gurdon Saltonstall, for a valuable series of Corals from Nassau.

General Meeting. March 7, 1877.

The President, Mr. T. T. Bouvé, in the chair. Forty-one persons present.

Messrs. L. L. Dame, Henry A. Holden, Allen Sullivant, Charles E. Swett, Rev. G. F. Wright, and Miss Jane Alexander were elected Associate Members.

Dr. B. Joy Jeffries gave an account of the theory of color blindness, and the practical relations of the subject, and his remarks were illustrated with diagrams and experiments.

The following papers were read:

The Florida Orthoptera collected by Mr. J. H. Comstock. By Samuel H. Scudder.

As no attempt has yet been made to tabulate the Orthoptera from any district in the southern United States, it has seemed desirable, in naming for Mr. Comstock the species collected by him in the spring of 1876, to print a list of them, with descriptions of those which prove to be new. The collection was made almost entirely at two localities — Jacksonville on the St. Johns, and Fort Reed in Orange Co., about three miles south of Mellonville, at the head of navigation on the St. Johns. So far as I am aware, no collections of any importance have before been brought from the upper St. Johns, so that this portion of the collection, and the larger one, has more than ordinary interest. A few notes sent me by Mr. Comstock are appended under the species to which they refer; and occasional notices of captures by others in other parts of the State, or of neighboring States, are added. The Collection is in the Museum of Cornell University.

Gryllides.

Gryllus assimilis (Fabr.) Goeze. 1 ♂, 1 ♀, found under boards on the beach near Sanford, April 6; 1 ♀, Ft. Reed, April 21; 1 ♀, Jacksonville, May 6. This agrees altogether with Saussure's description of the small black United States form of the species, excepting that the wings extend no further back than the tips of the cerci.

Gryllus pennsylvanica Burm. 2 ♂, 4 ♀, found under boards on the beach near Sanford, with the preceding, April 6; 3 ♀, Ft. Reed, April 20–22. One of the first mentioned females is much larger than the rest, but appears to be the same species. Although Saussure considers this a northern species, not occurring in the south, these specimens agree well with a specimen from Maryland, compared with Burmeister's type in the Halle Museum, and marked as agreeing therewith; the same specimen was indicated by Mr. Uhler as agreeing with specimens sent by him to Mr. Walker under this name, and which probably served as the base of Walker's determination. This form at least of the species I have never seen north of Maryland, and hence it appears to be a southern type. Saussure, however, considers the forms described by me from New England under the names of *G. niger* and *G. neglectus*, as identical with this.

Nemobius ambitiosus nov. sp. Allied to *N. carolinus* Scudd., but smaller and darker. Head not very convex, subappressed, the top dingy fulvous with broad dusky or blackish longitudinal stripes; whole front piceous with a moderately narrow pallid transverse stripe, widening slightly at the middle, and on the lower edge at each lateral ocellus; ocelli pale; antennæ fusco-luteous, much longer than the body, the basal joint subcastaneous; palpi, excepting the pallid penultinate joint, black. Pronotum quadrate, its borders straight with a rather strongly marked impressed line next the front edge black, sometimes heavily and obscurely blotched with dark fulvous, covered sparsely, like the top of the head, with long curving black bristles. Tegmina of ♂ black, more than half as long as the abdomen, quadrate, more than half as long again as broad, as broad at apex as at base, the tip broadly rounded and in the middle subexcised, the entire margin and the edge between the dorsal and lateral fields conspicuously bordered with pale yellow; tegmina of ♀ with the lateral field black, the dorsal field testaceous blotched with black, the veins dusky; less than half as long as abdomen, the inner apical angle strongly and roundly excised. Legs black, blotched heavily with luteo-testaceous, the hind tibial spines dull testaceous, mostly black or dusky in the middle half. Ovipositor black, straight, rather shorter than the hind femora; cerci varying from dull testaceous to castaneous.

Length of body, 7.75 mm.; of antennæ, 9 mm.; of pronotum, 1.6 mm.; breadth of pronotum, 2 mm.; length of tegmina, ♂, 3.5 mm.;

♀, 2.6 mm.; of hind femora, 5.5 mm.; of cerci, 4 mm.; of ovipositor 4.5 mm. 6 ♂, 5 ♀, Ft. Reed, April 20–22.

Cyrtoxipha delicatula nov. sp. A slender species, appearing the more slender from the great length of the wings; it is entirely of an amber color with a slight infuscation on the head, pronotum and hind femora, and with a few brownish dots at the insertion of hairs on the head and pronotum, especially next the hinder margin of the latter; antennæ three times as long as the body, of the same color, delicately pubescent with blackish hairs, and about every sixth joint dusky; penultimate joint of palpi decidedly longer than the preceding joint, the last triangular joint dusky at its broad apex. Pronotum twice as broad as long, rapidly and regularly increasing in size from in front backward, the front and hind borders straight, with a median impressed line and a few long curving dark tawny hairs, mostly arranged in four equidistant transverse rows. Tegmina of ♂ slightly longer than the body, the tympanum and all the open spaces of the dorsal field rugulose with irregular longitudinal lines, the accessory vein ("veine adventive" of Saussure) distinct throughout the lateral field with a very few faint, distant, transverse veins; wings fully twice as long as the tegmina; spines of hind tibiæ dusky or blackish at tip.

Length of body, 5.5 mm.; of body and closed wings, 11 mm.; of antennæ, 19 mm.; of pronotum, .95 mm.; greatest breadth of pronotum, 1.9 mm.; length of tegmina, 5 mm.; of hind femora, 5 mm.

1 ♂, Ft. Reed, April 23. I have also received a male of the same species from Sand Point, Florida, collected May 1, by Messrs. Hubbard and Schwarz (No. 409). The excessive length of the wings is a striking feature of this insect, which differs in several respects from *C. Gundlachi* Sauss., said by him to occur in the southern United States.

This species, excepting in the length of its wings, bears a close resemblance to the insect considered by Orthopterologists in this country as *Acheta exigua* of Say. Say's description does not fit the latter well, but in the absence of any insect yet found which agrees better with the characters he mentions, it has been, and may still be, considered the same. It is an Anaxipha, and occurs throughout the southern states from Texas to the Atlantic seaboard, and on the latter as far north as Maryland (Uhler). It was placed by Saussure doubtfully in Nemobius, but is not the insect referred to by me in the Boston Journal of Natural History (VII, 429) under that name. Mr. Comstock did not meet with any species of Anaxipha.

Locustariæ.

Thyreonotus dorsalis (Burm.) Scudd. 2 ♂, 1 ♀, taken at Ft. Reed, April 4–20. This species does not agree in structural characteristics with any of the genera of Decticidæ given by Herman, but approaches Thyreonotus more closely than any other.

Belocephalus subapterus Scudd. (*Acanthacara acuta* Thom. nec Scudd.) A larval ♂ was found at Ft. Reed, April 17.

Xiphidium ensiferum Scudd. A single pupa of this or an allied species was taken at Ft. Reed, April 21.

Amblycorypha rotundifolia (*Phylloptera rotundifolia* Scudd.). A single female came with the collection of Mr. Comstock, but unlabelled. As some western specimens were sent, this may not have been taken in Florida. I have received it from as far south as Georgia.

Microcentum retinervis (Burm.) Scudd. A male, a female and two pupæ were taken at Ft. Reed between April 4 and May 2.

Acrydii.

Dictyophorus reticulatus Thunb. A considerable number of larvæ and pupæ were taken May 6. They differ rather remarkably from the perfect insect, being of a very deep metallic bronze-green color approaching black, marked with yellow deepening into red in spots, or wholly with blood-red; this is most conspicuous in a slender dorsal stripe the whole length of the creature, extending over the fastigium half way down the lateral edges of the frontal costa; the lateral carinæ of the head, the lower border of the front and the lower half of the posterior border of the head are also marked broadly with it, as also the hinder edge of the pronotum; the antennæ are black throughout.

Aptenopedes (*'απτήν, πηδάω*) nov. gen.

Head projecting, front strongly oblique, whole summit of head horizontal, scarcely convex, triangular; the eyes nearly meeting above, and the fastigium in advance of them slightly tumid; front subappressed, particularly in the ♀; frontal costa distinct and equal throughout; eyes long oval, not prominent, in the ♀ depressed and tapering above; antennæ moderately slender, linear, subdepressed, about as long as (♀) or slightly longer than (♂) the pronotum; palpi rather small, the last joint nearly cylindrical, not in the least expanded. Pronotum regularly expanding posteriorly in the ♀, only expanding at the very tip and then but slightly in the ♂; front margin slightly convex, hind margin slightly and angularly excised; surface uniformly rugulose, tectiform, especially in the ♀, the median carina distinct but not prominent, lateral carinæ wanting; the posterior lobe separated from the anterior by a scarcely perceptible sinuate furrow, the posterior itself distinctly divided in the middle by a transverse furrow subparallel to the hind border severing the median carina; lateral lobes nearly twice as long as broad, narrowing downward, the exterior edge very broadly angled, the posterior margin roundly excised; prosternum with a blunt conico-cylindrical spine; inner margin of mesosternal lobes broadly convex, the lobes subapproximate in the ♂, distant from each other by half their width in the ♀; metasternal lobes approximate in both sexes. Tegmina linear, about as long as the pronotum; wings wanting. Hind femora extending nearly to (♀) or a little beyond (♂) the tip of the abdomen, the superior edge unarmed; hind tibiæ with their outer edges smooth, the spines on either side equal; first and third tarsal joints equal, the second less than half as long as either of them. Abdomen indistinctly carinate throughout.

The genus has an aspect not unlike that of Sphenarium, but it belongs to the subfamily of Acrididæ and appears to be somewhat closely allied to Rhytidochrota. *A. sphenarioides* may be considered as the type.

Aptenopedes sphenarioides nov. sp. Green, the upper surface a little infuscated in the male. Head with the whole front flecked with fuscous or blackish punctæ. Antennæ with the first two joints pale or greenish, beyond growing testaceous, the apical third blackish fuscous. Pronotum uniformly and dull rugulose, more obscurely on the deflected lobes than above, like the head furnished with very scattered delicate inconspicuous short white hairs and with a white or very pale pink straight lateral stripe running from the upper posterior border of the eye to the hind edge of pronotum; this stripe is bordered more (♂) or less (♀) distinctly with black beneath; lower edges of pronotum a little pale, especially in the male; prosternal spine terminating bluntly. Tegmina reaching the end of the first abdominal segment, white above, black below, in continuation of the pronotal stripe; metapleura more or less distinctly striped with black and white, in imitation of the tegmina. Hind femora green exteriorly, more or less infuscated, especially above, in the female, the outer carina obscurely marked with black, the space between this and the upper carina more or less distinctly testaceous in the male; hind tibiæ green with a plumbeous tinge, the spines black tipped. Abdomen obscurely punctate on the basal half, with small indistinct dorso-pleural spots of mingled white and blue-black dots on the posterior extremity of the segments, which in the male lie at the outer limit of a broad dorsal testaceous stripe which is bordered externally with blackish and so obscures the spots.

Length of body, ♂ 17 mm., ♀ 25 mm.; of antennæ, ♂ 7 mm., ♀ 7 mm.; of tegmina, ♂ 3 mm. ♀ 4 mm.; of hind femora, ♂ 10 mm., ♀ 11.25 mm.

8 ♂, 4 ♀, Ft. Reed, April 8–28. I have also received the species from Jacksonville, Fla., collected by C. J. Maynard in April.

Aptenopedes rufovittata nov. sp. Green, more or less infuscated above. Face minutely and rather sparsely dotted with blackish fuscous, the mouth-parts and the lower part of the face often decidedly pink; antennæ with the first two joints green, beyond either dull green, more or less infuscated (♂), or with the basal half reddish or pinkish brown and the apical half olivaceo-fuscous (♀); eyes as in *A. sphenarioides.* Pronotum rugulose, much more heavily in the ♂ than in the ♀, and the dorsum of the other thoracic joints and the basal abdominal joints similarly marked; pronotum with a distinct (♀) or inconspicuous (♂) median carina, obscurely infuscated in the ♂, generally marked distinctly but narrowly with testaceous in the ♀, the surface of the whole pronotum with a few scattered hairs, even more sparsely distributed than in *A. sphenarioides*; position of the lateral carinæ (which are wanting) marked by a slender black stripe, followed above by a somewhat broader rufous band, fading to yellowish and narrowed in the female; this stripe does not extend upon the head. Tegmina wanting in the ♂, very slender, linear, straight and green in the ♀. Legs green, the hind femora tipped, at least in the male, with rufo-testaceous and black, the hind tibiæ glaucous, hind tarsi red with black-edged pad and black-tipped red claws. Abdomen with an obscure testaceous medio-dorsal stripe in the female, extending onto the thorax, and on the abdomen followed by an obscure pleuro-dorsal series of small dark spots, or with a similar distinct stripe in the ♂, bordered by a more or less distinct narrow or broad edging of black, fading laterally into fuscous; anal cerci of ♂ tapering almost uniformly, while in *A. sphenarioides* they taper only on the basal half and beyond are equal.

Length of body, ♂ 15.5 mm., ♀ 20.5 mm.; of antennæ, ♂ 6.5 mm.;

♀ 5.4 mm.; of tegmina, ♀ 1.85 mm.; of hind femora, ♀ 8.5 mm., ♀ 10 mm.

4 ♂, 3 ♀, Ft. Reed. April 10 (♂), April 20–21 (♀).

Aptenopedes aptera nov. sp. Green. Eyes narrower than in *A. sphenarioides*, more closely approximated above and the fastigium in advance of them less swollen. Thorax with similar sculpturing but wholly devoid of any lateral stripe. Pronotum a little shorter than in the preceding species; no trace of tegmina. Legs as in the previous species, except in wanting the testaceous color on the upper outer surface of hind femora. Abdomen green, with a medio-dorsal stripe of testaceous, having an obscurely infuscated edge extending also to the hinder edge of pronotum.

Length of body, 24 mm.; of antennæ, 6.5 mm.; of hind femora 10.5 mm. 1 ♀, Ft. Reed, April 7th.

Acridium americanum (Drury). 3 ♂, 2 ♀, Ft. Reed, and Jacksonville, from April 10 to May 6.

Acridium appendiculatum Uhl. 13 ♂, 2 ♀, taken at Fort Reed between Mar. 26 and April 22, and 1 ♂ taken at Jacksonville, May 6. Appalachicola (Thaxter). *A. distinctum* Uhl., Mss. is the male of this species.

Abbé Provancher has sent me this species from Quebec! It is his *A. rugosum*.

Caloptenus femur-rubrum (DeG.) Burm. The common southern species, with the hind tibiæ varying from pale red to pale yellowish green, and which I provisionally refer to this species, was taken at Fort Reed April 8 to 23, and Jacksonville May 6, in abundance. Pupæ were taken at Ft. Reed April 2 to 28.

Pezotettix rotundipennis nov. sp. Caloptenoid in form. Head livid yellowish brown, the summit deeply infuscated, the whole more or less mottled with small fuscous spots; antennæ dull brownish red, apically infuscated, at extreme base more or less livid. Pronotum above brownish fuscous, mottled slightly with dusky yellow, the median carina black; lateral lobes brownish yellow below, above occupied by a broad piceous stripe running from the eye nearly to the middle of the abdomen, broader and with vague boundaries on the abdomen and partially interrupted by a slender oblique brownish yellow stripe on the crest of the metapleural episterna. Tegmina but little longer than broad, rotund, ovate, black, concealed by profuse rufous veins. Legs dull yellowish brown, the middle and hind femora heavily spotted with black, the hind tibiæ dull fusco-glaucous, pale at base. Head not very large; vertex between the eyes scarcely so broad as the basal joint of antennæ, shallowly and broadly sulcate in advance of the eyes; frontal ridge moderately broad, shallowly sulcate throughout, slightly and regularly expanding beneath, obsolescent next the clypeus. Pronotum broadening slightly and regularly throughout, the anterior lobe almost twice as long as the posterior, its surface very faintly and very sparsely punctate, the median carina sharp but slight and equal; posterior lobe with the median carina not sharp but rather inconspicuous, the surface of the lobe both above and on sides delicately rugulose; lateral carinæ wholly obsolete. Terminal segment of male strongly upcurved, tumid posteriorly; cerci rather stout but laminate, tapering at the very base, beyond nearly equal, moderately broad, directed inward and backward and bent obliquely a little downward, slightly expanded, well rounded and scarcely thickened at the tip.

Length of body, 15.5 mm.; of antennæ, 8 mm.; of tegmina, 3 mm.; of hind femora, 10 mm. 1 ♂, Jacksonville, May 6.

Pezotettix puer nov. sp. Caloptenoid in form. Head livid brown, heavily mottled with dusky brown in small spots, often deepening, especially above, to blackish brown; antennæ dull yellowish brown, deepening to dark fuscous beyond the middle, the basal joint longitudinal, streaked more or less noticeably with blackish. Pronotum brownish yellow, more or less infuscated above, the upper portion of the deflected lobes, especially in the male and in front, heavily marked with piceous, sometimes scarcely infuscated in the female only. Tegmina shaped and colored as in the preceding species, but paler in the female than in the male, widely separated. Legs variable in color, but generally dull yellowish brown, the hind femora generally twice banded above, besides the black apex, the hind tibiæ dull yellow mottled with brown at base and extreme tip, the rest purplish glaucous. Head and pronotum shaped and sculptured as in the preceding, excepting that the lateral carinæ are distinct throughout and straight, but not sharp. Terminal segment of male a little upturned, the anal cerci slender beyond the thickened base, scarcely tapering, gently incurved, the tip bluntly pointed.

Length of body, ♂, 10.5 mm., ♀, 16 mm.; of antennæ, ♂, 5.5 mm., ♀, 7 mm.; of tegmina, ♂, 2.2 mm., ♀, 2.5 mm.; of hind femora, ♂, 8 mm., ♀, 10 mm.

5 ♂, 4 ♀, Ft. Reed, April 8–10. This is the smallest American species of the genus known to me.

Paroxya recta Scudd. 3 ♂ and a pupa were taken at Ft. Reed May 1–2; another pupa April 10; taken at Enterprise, Florida, by Messrs. Hubbard and Schwarz, May 15 (No. 423).

Paroxya atlantica Scudd. 6 ♂, 2 ♀, were taken at Ft. Reed: the ♂ April 2–20, the ♀ April 23.

Arnilia chlorizans (Walk.). 10 ♂, 2 ♀, Ft. Reed, April 21 – May 1. Appalachicola (Thaxter).

Leptysma marginicollis (Serv.) Stål. 7 ♂, 2 ♀, Ft. Reed, April 7 – May 2; taken at Enterprise, May 25, by Messrs. Hubbard and Schwarz (No. 421), and at Appalachicola by Mr. Thaxter.

Achurum brevipenne (Thom.). A large number of mature specimens were taken at Ft. Reed between April 5 and May 1, together with a few pupæ. It appears to have been an abundant species, and Mr. Comstock remarks that both the form and coloring of the insect appear to be protective; the insect occurs on the "wire-grass" which grows in the sand among the saw-palmettos; and so closely do their brown linear bodies resemble dry grass, that it is very difficult to perceive them.

Amblytropidia subhyalina Scudd. 8 ♂, 4 ♀, mostly at Ft. Reed, April 17 – May 1; taken at Ft. Capron in April, by Messrs. Hubbard and Schwarz (No. 435), and at Appalachicola by Mr. Thaxter.

Abbé Provancher has sent me this species from Quebec, Canada! It was described by him as *Chloealtis canadensis*.

Chloealtis viridis Scudd. 19 ♂, 21 ♀, mostly at Ft. Reed (the others at Jacksonville); the males April 11 – May 6, the females April 22 – May 6; a large number of larvæ and pupæ were also taken at Ft. Reed, April 8–28; taken May 18th at Enterprise, by Messrs. Hubbard and Schwarz (No. 449).

Chrysochraon obscurus nov. sp. Dark yellowish brown. Head prominent, projecting, the face more than usually oblique in the male; fastigium of vertex moderately broad, elongated, acute-angled, convex, scarcely declivant, bluntly rounded at the tip; lateral foveolæ pretty strongly depressed in front, with obscure inner border ovate-subquadrate, about twice as long as broad; frontal costa deeply sulcate, especially above the ocellus, narrowing at summit, broadening on lower half; whole front distantly and faintly punctate; whole head dotted very sparsely with black, and in the male striped above and on sides with the same; summit of head transversely and faintly wrinkled; antennæ a little depressed, light brown, deepening to dark fuscous beyond the base. Pronotum rather roundly constricted just in advance of the middle, front and hind borders straight, median and lateral carinæ equal and slight; surface punctato-subrugose, the region of the lateral carinæ more or less deeply, and narrowly (♀), or broadly (♂) marked with blackish; both disk and lateral lobes with occasional, irregularly distributed, large blackish dots, sometimes obsolete. Tegmina three-quarters (♂), or scarcely half (♀) as long as the abdomen, fusiform, tapering apically (♀) or linear (♂), yellowish brown, with a median dusky stripe often broken into alternate blackish and paler spots. Legs dark yellowish brown, the hind femora more or less and variably infuscated; hind tibiæ pale yellowish brown; the spines pale at base, black at tip. Abdomen more or less mottled with brownish yellow and dark fuscous.

Length of body, ♂, 13.5 mm., ♀, 21.5 mm.; of antennæ, ♂, 7 mm., ♀, 6 mm.; of tegmina, ♂, 6.6 mm., ♀, 6 mm.; of hind femora, ♂, 9.4 mm., ♀, 12 mm.

3 ♂, 1 ♀, Ft. Reed, April 8–11.

Stenobothrus maculipennis Scudd. 29 ♂, 17 ♀, and 8 pupæ taken at Ft. Reed, April 8 – May 2, and Jacksonville, May 6. The individuals are considerably larger than those from the north, first described under this name.

Tomonotus Zimmermanni Sauss. 22 ♂, 4 ♀, at Ft. Reed and Jacksonville, March 26 – May 6. Appalachicola (Thaxter). This species is not mentioned by Thomas in his Acrididæ of North America.

Chimarocephala viridifasciata (DeGeer) Scudd. 27 ♂, 11 ♀, of the type *infuscata*; 2 ♂, 25 ♀, of the type *virginiana*. Both sexes of both forms were taken, as early as March 26, and as late as May 6, with the exception of the two *virginiana* ♂, which were both taken May 6. Five sixths of the females of both forms were taken after April 21, and two thirds of the ♂ of *infuscata* after that date; so that there appears to be no evidence that one form is earlier than the other. 11 larvæ and pupæ were taken at Ft. Reed, April 10–25.

Hippiscus discoideus (Serv.) Stål. 4 ♂, 3 ♀, were taken at Jacksonville, May 6; and three larvæ and pupæ at Ft. Reed, April 5–10.

Dissosteira carolina (Linn.) Scudd. A single ♂ was taken on May 6, at Jacksonville; it was taken at Enterprise May 10, by Messrs. Hubbard and Schwarz (No. 426).

Psinidia eucerata (Harr.). 24 ♂, 18 ♀, and 2 pupæ, Jacksonville and Ft. Reed, mostly the latter, between April 6 and May 6; taken at Ft. Capron, April 19, by Messrs. Hubbard and Schwarz (No. 442), and at Appalachicola by Mr. Thaxter. Mr. Comstock took this insect on white sand, and remarks that the lighter parts of the body and tegmina exactly resemble the color of the sand where they occur, while the darker parts correspond to the burnt vegetable matter always found mingled with the sand; and the mottling produces so perfect a mimicry that he has often been unable to distinguish a grasshopper which he had seen alight within six feet from where he stood.

Trimerotropis picta Scudd. 16 ♂, 13 ♀, and 5 larvæ and pupæ, Ft. Reed and Jacksonville, at the same time as the preceding; taken at Cedar Keys, by Messrs. Hubbard and Schwarz, June 4 (No. 441), and at Appalachicola by Mr. Thaxter.

Tettix rugosus Scudd. 10 ♂, 19 ♀, taken at Ft. Reed, April 22–26, and 1 ♂ taken April 6, at the same place. Mr. Comstock found all the species of Tettigididæ in damp places on black muck.

Tettix arenosus (*Tetrix arenosa* Burm.). 4 ♀, Ft. Reed, April 20–21. I have recently received the same species from Georgia; it is closely allied to *T. rugosa* Scudd., but the wings scarcely surpass the pronotum, a feature which appears to be constant.

Tettigidea lateralis (Say) Scudd. 19 ♂, 17 ♀, and 14 larvæ and pupæ were taken at Ft. Reed, April 20–26; taken at Appalachicola by Mr. Thaxter.

Batrachidea cristata (Harr.) Scudd. 5 ♂, 6 ♀, and 2 pupæ were taken at the same time and place as the preceding.

A few immature Tettigidæ remain undetermined.

Mantides.

Oligonyx graminis (*Thespis graminis* Bates' Mss.). Body filiform. Head strongly depressed, with a transverse central sulcus; eyes large, obovate, very prominent, diverging posteriorly; posterior border of head tuberculate at outer angles; clypeus, and all parts in advance of eyes, forming a small triangle, at the apex of which is the minute mouth; ocelli very large and prominent, equidistant, obovate; antennæ pubescent; whole head testaceous, obscurely dotted with black, the ocellar scrobes black. Prothorax very long, linear, a little expanded at the base of the legs, in front of them gently tapering; median carina slight, fading in front of the legs; lateral carinæ equally slight, minutely denticulate; surface smooth, very sparsely and briefly pubescent, brownish testaceous, obscurely dotted with black. Tegmina minutely pubescent, slender, reaching the tip of the third abdominal segment, rounded at tip, very light uniform translucent brown, very faintly iridescent; wings extending beyond the tegmina by more than half the length of a segment of the abdomen, colored like the tegmina. Front legs long, pubescent; coxæ and femora of equal length, lighter than the prothorax, marked irregularly, or dotted with blackish fuscous, furnished with long spines on apical third; tibiæ extremely short, enlarging apically with four apical black tipped spines, of which one is much longer than the others; tarsi reaching just beyond the middle of the femora. Abdomen very long and slender, of the color of the pronotum, and more abundantly pubescent, with longer white hairs; supraanal plate long and tapering, triangularly lanceolate, carinate, projecting far beyond the abdomen; cerci long, equal, depressed, pubescent, 7-jointed; styles slender, tapering, nearly half as long as the supra-anal plate.

Length of body, 47 mm.; of antennæ, 23 mm.; of prothorax, 12.75 mm.; greatest width of same, 1 mm.; length of tegmina, 18 mm.; of fore femora, 8 mm.; of fore tibiæ, 1 mm.; of hind tibiæ, 10.5 mm.; of cerci, 4 mm.

1 ♂, Ft. Reed, April 24. The species has also been taken in Florida, by Mr. Norton, and I have others from Georgia, all of them males. It differs conspicuously from *O. Scudderi* Sauss., supposed to come from Georgia, in the length of the prothorax. The specimens in my collection agree perfectly with those labelled *Thespis graminis* Bates' Mss., in the British Museum; as Mr. Bates is understood to have abandoned his purpose of preparing a monograph of the Mantidæ, based on the British Museum collection, I have no hesitation in describing it, and adopting therefor the appropriate specific name he has applied.

A male pupa of another Mantid was taken at Ft. Reed, April 7, apparently belonging either to Miopteryx or to Thespis; but certainly not to *T. cubensis* Sauss., the only species of either genus recorded from the neighborhood of the Southern States.

Blattariæ.

Phyllodromia germanica (Linn.) Serv. A number of specimens in various stages of growth, were taken at Ft. Reed, March 27.

A single specimen of a second species of the genus was taken at the same place, but is in an indeterminable condition.

Ischnoptera unicola (Scudd.) Brunn. Specimens were taken in houses at Fort Reed from March to May.

Platyzosteria ingens nov. sp. Dark mahogany-brown, nearly uniform, but deepening toward the sides and extremity of the abdomen, and especially on the tegmina, which sometimes become nearly black, the head and under surface lighter. Head obscurely mottled with dusky, with a pale dot next the inner edge of the antennæ, the eyes black, the labrum and mouth-parts mottled with yellow; antennæ marked with black on the basal joints, throughout pubescent, as long as the body. Pronotum semi-orbicular, gently convex, with minutely dilated edges and scarcely shagreened surface. Tegmina subquadrate, the outer margin gently marginate and scarcely rounded, the inner edge slightly convex, especially next base, the outer margin almost straight, but owing to the slightly produced and rounded outer angle, a very little concave; they just cover the mesonotum, and together cover the whole breadth of the same, excepting at a scutelliform space in front in the middle; their surface is punctate. Legs stout, profusely spined, the coxæ heavily blotched with yellow, and the under surface of tarsi clay-yellow. Abdomen broad, scarcely broader beyond the base, the extremity broadly rounded, the surface, especially behind, rugulose; joints produced laterally, especially the apical ones, where the lateral angle becomes a distinct pointed tooth. Supraanal plate broadly and roundly excised on hind border, ciliate with rufous hairs, and the outer angles rounded (♂), or rather deeply and angularly excised, the outer angles sharp (♀); cerci depressed, tapering, pointed, either longer (♂) or shorter (♀) than the supra-anal plate.

Length of body, ♂, 31 mm., ♀, 35 mm.; of antennæ, ♂, 31 mm., ♀, 30 mm.; of pronotum, ♂, 9 mm., ♀, 9 mm.; breadth of same, ♂, 14 mm., ♀, 14 mm.; length of hind femora, ♂, 9 mm., ♀, 9 mm.; of hind tibiæ, ♂, 10.5 mm., ♀, 10 mm.; of hind tarsi, ♂, 7.5 mm., ♀, 6.5 mm.

3 ♂, 1 ♀, houses at Ft. Reed, March – May. I have also received the species from unspecified localities in Florida, from Messrs. Norton

and Osten Sacken, and from Volusia (Samuels), Green Cove Springs (Boardman), Appalachicola (Thaxter) and Ft. Capron in April, Messrs. Hubbard and Schwarz, No. 588, and from Cuba (Uhler), in all 5 ♂, 5 ♀. Some of these specimens I have compared with the types of the Cuban *P. opaca* Brunn., in Brunner's collection, from which this species is certainly distinct (as Mr. Brunner agrees with me in believing) in its slenderer legs, longer tegmina, and in the absence of certain spines on the hinder abdominal segments. I noticed this species in the Berlin Museum, but failed to note from what locality they came.

Platyzosteria sabalianus nov. sp. Head mahogany-brown, growing yellow toward labrum, blotched everywhere with fuscous, and with a pale spot below either antenna; eyes black; palpi, especially apical joints, more or less infuscated; antennæ of the color of the head, growing paler toward the tip, pubescent, though at base but very sparsely, longer than the body. Pronotum longer than half the breadth, well rounded, the sides very delicately marginate, surface smooth, black, with the centre of posterior half rufo-castaneous, the sides with a broad yellow band, just avoiding the margin, narrowing in front by a broadly rounded excision of its inner border; the band extends with fully equal breadth upon the mesonotum, and to a greater or less extent on to the metanotum, and is very conspicuous; on the meso- and metanotum, which are rufo-castaneous, it is broadly margined interiorly with black. Tegmina wholly wanting. Legs moderately stout, profusely and coarsely spined, the coxæ fuscous, blotched with pale yellow, the rest of the legs dark castaneous, some of the tarsal joints partially infuscated. Abdomen dull rufo-castaneous, very broadly bordered laterally, and more narrowly apically with black, with an almost imperceptible median carina, the lateral edges produced apically to a delicate point, the last three joints with very distant, very brief rufous hairs springing from raised points. Supraanal plate rather deeply and angularly excised, the lateral projections bluntly pointed; cerci depressed and tapering, pointed, twice as long as the supraanal plate.

Length of body, 20 mm.; of antennæ, 23 mm.; of pronotum, 6.3 mm.; breadth of same, 10.5 mm.; length of hind femora, 6.1 mm.; of hind tibiæ, 7.5 mm.; of hind tarsi, 5 mm.

2 ♂, Sanford, in tops of the Cabbage Palmetto (*Sabal Palmetto*) April 6. It is closely allied to *P. mysteca* Sauss.

Periplaneta americana (Linn.) Burm. 4 ♂, 3 ♀, and young, from houses at Fort Reed, March, April and May.

Periplaneta australasiæ (Fabr.) Burm. Several young of this species were taken at Ft. Reed during March, April and May. This cosmopolitan species was first sent to me from Green Cove Spring, Florida, by Mrs. Mary Treat, under the name of "the Florida cockroach," and she reports that it frequently occurs in the pitchers of Sarracenia,[1] and has been extremely abundant in Florida for eighteen years, the torment of housekeepers. Yet it has never before fallen into my hands, nor has it been hitherto recorded from the United States. A single specimen in the collection of Dr. Harris is marked "introduced; in ships from China."

Forficulariæ.

Labidura riparia (Pall.) Dohrn. A single specimen taken at Ft. Reed, April 24. Taken at Indian River, by Messrs. Hubbard and Schwarz, April 27; at Appalachicola, by Mr. Thaxter.

Labia guttata Scudd. One specimen taken at Ft. Reed, March 26.

List of Mammals found in the Vicinity of Grand River, D. T. By W. J. Hoffman, M. D., late U. S. Army.

The Military Post at Grand River,[2] Dakota Territory, was established May 20, 1870. It is situated on the western bank of the Missouri River, one hundred and eight miles, by land, south of the present terminus of the Northern Pacific Railroad, and three hundred and seventy miles north of Yankton. The valley of the Missouri was well timbered in this vicinity prior to 1870, but since that time the groves of cottonwood and oak have been gradually cut away, affording but scanty shelter for many animals seeking them during the cold season. Grand River, Oak Creek, and several smaller streams emptying into the Missouri from the west, are often nearly dry courses during the summer; but as we ascend to the distance of fifty or sixty miles, we find them containing a greater amount of water than nearer the mouth, and running through broad, well-timbered valleys. At such localities many of the larger mammals

[1] See Harper's Magazine for October, 1876.

[2] Approximate astronomical position is Long. 100° 12′ W., Lat. 45° 31′ N.

are still found, unless the resident Dakotas have been on a hunt, when few escape unless they take to the surrounding prairie. The prairie is undulating, and at times hilly, destitute of wood (except small quantities in the ravines and washes leading down to the timbered bottoms) but covered with short grass, frequently with greasewood (*Obione canescens*), sage brush (*Artemisia canadensis*), cactus (*Opuntia missouriense*), etc. The western horizon is bounded by a range of bluffs, the more elevated peaks of which are frequently used by the Dakota Indians for signal stations.

To most of the following named species are added the local names in Dakota, the Tetonwan dialect of that language being generally spoken around the Agency. The italicized *n* is nasal; ich is sounded as in German *nicht*; vowels as in Continental languages generally.

FELIDÆ.

1. **Felis concolor** Linn. American Panther. In-mu-ta*n*′-ka. Occasional specimens are captured in the oak groves on Oak Creek. The skins are seldom brought to the trader's store to exchange, as they are valued by the Indians in the manufacture of quivers.

2. **Lynx rufus** Raf. Bay Lynx; Wild Cat. In-mu-cho′-ta. This species is of frequent occurrence throughout the valleys. A large specimen was shot within half a mile of the Post, where she had been watching for her prey near a beaver dam.

CANIDÆ.

3. **Canis lupus** var. **occidentalis** Allen. Gray Wolf; Timber Wolf. Shu*n*′-ka-to-ki′-tcha.

Rather abundant, and is usually found in the wake of a pack of coyotès. The coloration varies greatly, in fact so much so, that different local names are applied to the same species on that account. It is frequently the case that a pedestrian will meet these animals along the *coulèes*, and on firing at them, if they are not hit, they will remain in one position until their curiosity is satisfied, when they will walk off deliberately and slowly. This, however, is not the case when they are hungry, at which time they become extremely fierce and bold. They have been known to enter the Indian villages at night and attack the dogs.

4. **Canis latrans** Say. Prairie Wolf; Coyotè. Shu*n*′-ka-mon′-i-tu.

Everywhere common. Large numbers are attracted to the Agency corral, where the offal is left after the Indians receive the weekly allowance of beeves — usually one hundred head. Many hundred skins are annually brought to the trader's, where they receive a worthless trinket in return for each. Occasional specimens have been shot from the windows of the out-buildings. Various attempts at domestication have failed.

5. **Vulpes fulvus** Rich. Red Fox. Shu*n*′-ka-da*n*.

Not found near the settlement. Sometimes found by the Indians near the headwaters of Grand River and Oak Creek. Few skins are sold, as the Indian women retain them to make pouches and bags.

6. **Vulpes fulvus** var. **argentatus** Aud. and Bach. Silver Fox. Shu*n*′-ka-da*n*′-ska.

Extremely rare. Have seen no skins among the tribes, but I was told that this animal was of frequent occurrence before any of the Agencies had been established.

7. **Vulpes velox** Aud. and Bach. Kit Fox; Swift.

Not found nearer than the Big Horn Mountains or the Black Hills, although they formerly existed here. Visiting "hostiles" sometimes have skins for sale or barter.

MUSTELIDÆ.

8. **Mustela americana** Turton. American Sable. Pine Martin. Nak′-pa-gi′-tcha.

Apparently not numerous. I saw several specimens eight miles west of the Post, but they are more frequently met with further inland along the streams.

9. **Putorius longicaudus** Rich. Weasel. Hi-ta*n*′-ka-sa*n*.

Rare near the Agency, but found both above and below, on the Missouri bottom-lands.

10. **Putorius vison** Gapper. Common Mink. Dōk-si*n*′-tcha.

More frequently found than the last, but by no means common.

11. **Putorius nigrescens** Aud. and Bach. Little Black Mink.

Have not seen any specimens or skins. Old hunters describe an animal at one time found here, which *may* be the species in question.

12. **Gulo luscus** Sab. Wolverine.

Occasionally found near the head waters of Oak Creek.

13. **Lutra canadensis** Sab. American Otter. Pta*n*.

Very rarely found. Sometimes a skin or two find their way to the trader's during a season.

14. Mephitis mephitica Bd. Skunk. Ma′-ka′.

Not very common. These animals are killed by the Indians, though they seldom cure the skins on account of the fetid odor accompanying them.

15. Taxidea americana Waterh. American Badger. Cho′-ka.

Common at the prairie-dog towns eight miles northwest of the Agency. The Indians make tobacco pouches of the skins.

URSIDÆ.

16. Ursus horribilis Ord. Grizzly Bear. Ma-to′-cho-ta.

At one time they were found between Grand River and Ft. Rice; they are still known to occur rarely in the *Mauvaises Terres*, and to be common in the Big Horn Mountains, Montana. A necklace made of the claws is considered by the Indians to be worth two horses—about fifty dollars.

17. Ursus americanus Pallas. Black Bear. Wa-cha*n*-ksi′-tcha.

Same as the last, though skins appear to be more common amongst the aborigines. The fat of the paws is highly prized by the women, who mix it with the finely chopped hair of the tail of *Cervus macrurus*. After this mixture has been fried, it is employed to produce abortion. It may produce severe gastric irritation, which might cause such a result. Such is the general belief, and if true, the dose is really a disgusting one.

18. Ursus americanus var. **cinnamomeus** Aud. and Bach. Cinnamon Bear.

The Indians state that the only places where this animal is met with are in the Black Hills, and in the Big Horn country. Saw a single robe brought to the Post, that was badly worn.

SCIURIDÆ.

19. Sciurus hudsonius Pallas. Red Squirrel. Tash-na-he′-tcha.

Sometimes found in the oak groves eight miles west of the Post. This animal is found, upon comparison, to be identical with Pennsylvania specimens, although it was considered otherwise by some of the old settlers and trappers.

20. Tamias quadrivittatus Wag. Missouri Striped Squirrel.

Rather common on the plains and river bottoms where there are any moist places, and where shrubbery occurs. It usually burrows under a cluster of small bushes, or along-side of an old stump where the soil is loose.

21. **Spermophilus tridecem-lineatus** var. **pallidus** Allen. Striped Gopher.

Not common. Found sometimes on the prairie west of the Agency.

22. **Cynomys ludovicianus** Bd. Prairie Dog. Sho-sho′-na.

A large town or colony of these animals is located about eight miles northwest of the Agency. The nearest point to water is over two miles, but this distance from water is common, as the burrows are generally found in the most barren portions of the plains. The area covered with deserted holes and hillocks, in addition to that section at present occupied, exceeds four square miles. I have yet to find any instance where the burrowing owl (*Speotyto cunicularia* var. *hypogœa* Coues) occupies any but the deserted burrows, notwithstanding numerous random assertions to the contrary. The same applies to the rattlesnake (*Caudisona confluenta* Say), except in case where they are in search of the young prairie dogs for food. The animals are very readily domesticated. The skins are much used by the Indians for pouches, being often handsomely ornamented with beads or porcupine quills.

23. **Castor canadensis** Kuhl. Beaver. Chap′-pa.

The only locality where this animal was observed was in Oak Creek, one mile from the Agency. Skins are frequently obtained from the Indians, who secure them at various points on the streams, at from ten to fifty miles inland. The enlisted men had succeeded in taming several, but experienced difficulty in keeping them in captivity.

SACCOMYIDÆ.

24. **Dipodomys ordii** Woodh. Jumping Rat. Si*n*′-te-shda′.

Genl. D. S. Stanley informs me that he has captured this animal at Fort Sully, eighty miles south of Grand River. I have not observed it at the latter place, although skins are frequently found among the collections of pelts brought here by the Indians. They may have obtained them further west, as I saw numbers of them in the Valley of the Yellowstone. See also Prof. J. A. Allen's "Notes on the Nat. Hist. of portions of Montana and Dakota"; (Proc. Boston Soc. Nat. Hist., Vol. XVII, June, 1874, p. 12).

GEOMYDÆ.

25. **Thomomys rufescens** Maxim. Fort Union Gopher. Mau-i′-tcha.

Rarely found. Appears more common in the valleys of the Yellowstone and Upper Missouri.

HYSTRICIDÆ.

26. **Erethizon dorsatus** var. **epizanthus** All. Porcupine. Pa-hi*n*′.

Common in the timbered bottoms on Oak Creek. This animal is rapidly disappearing on account of the Indians, who prize the quills very highly, and employ them in the ornamentation of almost all wearing apparel, and trinkets, pouches, etc. The only living specimens were those domesticated by the enlisted men, and they are disagreeable pets on account of the odor.

MURIDÆ.

27. **Mus musculus** Linn. Common Mouse. Ki-tu*n*-ka-da*n*.

This animal made its appearance soon after the Post was established, and they have steadily continued to increase since that time. Specimens have been found in the wood-choppers cabins, forty miles northward, which were no doubt carried there in cases of goods or with sacks of grain.

28. **Fiber zibethicus** Cuv. Muskrat. Si*n*k-pe′.

Not rare, excepting in the immediate vicinity of the Agency.

LEPORIDÆ.

29. **Lepus campestris** Bach. Prairie Hare. Mas-ti*n*′-tcha.

Scattered over the prairie during summer, but as the cold weather sets in they are forced down into the bottom lands, where they are often secured for the table.

30. **Lepus callotis** Wagl. Jack Rabbit.

Of common occurrence, though seldom found very near the Agency.

CERVIDÆ.

31. **Cervus canadensis** Erxl. Elk. Wapiti. Ech-a′-ka.

Saw several about forty miles below Grand River, but they have not been found near the Agency since 1869. The Indians often bring in fine sets of antlers, which are secured along the tributaries of the Yellowstone.

32. Cervus virginianus Boddært. Virginia Deer. Tach-i*n*-tcha.

I saw none of this species, but was told that it was common in former years. Several sets of horns in the hospital steward's collection appear to belong to this species, but they were obtained in the Black Hills.

33. Cervus leucurus Doug. White-tailed Deer.

Not found near the Missouri at present, but occurs occasionally in the *Mauvaises Terres* of the Little Missouri River. A pair of antlers in the above named selection shows a remarkable development of intertwined branchlets and snags from the skull upward, to a distance of about eight inches, gradually diminishing. There were no bifurcations of the upper snags, as is the case in *C. macrotis*.

34. Cervus macrotis Say. Black-tailed Deer. Si*n*-te′ sa-pe-da*n*.

Occasionally appears in the valley of the Missouri, but is seldom found nearer than the *Mauvaises Terres.*

CAVICORNIA.

35. Antilocapra americana Ord. Prong-horned Antelope. Tach′-tcha.

This is the most common of all the larger mammals, and frequently specimens are shot from the stockade when they come down to the river to drink. During the summer of 1873 a fatal epidemic raged among the prong-horns, which Prof. Allen[1] thinks destroyed from three-fourths to nine-tenths of the animals along the surveyed route of the Northern Pacific Railroad.

This epidemic appeared at the same time with the epizoötic, and I believe that to be the cause. The Government stock, as well as nearly all of the Indian ponies, were affected, the greater fatality occurring among the latter. At encampments where the Indians procured water from pools and ponds, and where their horses drank from the same bodies of water, nearly sixty-four per cent. of the Indians were affected with *cerebro-spinal meningitis*, of which ten or twelve per cent. died. If the horse epidemic was not the cause of fatality among the antelope, it is at least a very remarkable coincidence.

At Grand River I observed a horn having two perfectly formed snags, one above the other, so that the upper one was in the usual position while the lower one was about half way between it and

[1] Proc. Boston Soc. Nat. Hist. Vol. XVII, June, 1874, p. 10.

the skull. The Indian who had worn it as a charm informed me that both horns were alike. For a sketch of the specimen, see Proceedings of the Zoological Society of London, Nov. 2, 1875.

36. Ovis montana Cuv. Bighorn; Rocky Mountain Sheep.

There is no doubt that this animal was at one time common along the bluffs of the Missouri River. I have frequently found partially decayed horns in the washes and *coulèes* in the vicinity of the Post. Horns are often brought in by the Indians, but they secure them either in the *Mauvaises Terres*, or still further west. Old skins are often seen in the Indian settlement, but I have not observed any recently cured specimens.

37. Bos americanus Gmelin. American Bison; "Buffalo." Ta-ton′-ka.

This animal disappeared from this portion of the Missouri Valley about 1869. Since that time they have gradually made their course of migration further west, until now they are seldom found nearer than from four hundred and fifty to five hundred miles. The intervening country is filled with old trails. In the summer of 1870 two old bulls strayed eastward, until they got within ten miles of the Agency. Several hundred Indians immediately started out, each hoping to reach them first.

At rare intervals individuals are found having an exceedingly soft, fine skin; these are known as "silk robes," and are valued at about three hundred dollars. Black robes are found, though very rarely. *Melanism* may be considered common when compared with the cases of total *albinism.*

"Grease," Chief of the Cut-Head band of Sioux, is the possessor of a white robe. It is worn by him as a cloak, while the cuttings and odd pieces were made into a cap.

The number of Dakotas registered at the Agency, was thirteen thousand five hundred; five thousand drew rations regularly, while eight thousand five hundred were "hostiles." The resident Indians used many robes themselves, and during the year had but from two to three hundred to exchange at the trader's. The "hostiles," who do most of the hunting, took in one year (1872–73) over thirteen thousand robes to Fort Peck, where they received, at that time, one Winchester rifle for three hundred robes, making the weapon worth about *two thousand dollars.*

The Medical Director of the Department of Dakota informed me that he was positive that the epidemic of small-pox which broke out in New York City and other localities in the east, originated in Dakota. The tribe afflicted sold their bales of robes, which were shipped to New York. Had the sale been prohibited and the robes burnt, the disease might have been prevented. The Medical Director saw the importance of such a measure but was powerless, for had the robes been burnt they might have charged for many silk robes, bringing the half-breeds and "squawmen" to bear testimony in behalf of the Indians' extortionate demands, in which the case would have resulted.

It is rather singular that there are no representatives of the *Vespertilionidæ* in this region. Specimens of several species occur on the Yellowstone and Musselshell Rivers, but they are unknown at Grand River Agency.

Mode of Forking among Astrophytons. By Theodore Lyman.

Governor John Winthrop (Philosophical Transactions, Vol. IV, p. 1152, 1670) made a calculation of the number of twigs in his Stellar Fish (*Astrophyton Agassizii*). He assumed that the increase in the branches was by a uniform and equal bifurcation, so that each succeeding set of twigs was twice as numerous as its predecessor. By this theory, a specimen each of whose arms forked twelve times would have a total of 20,475 forks, or 20,480 terminal twigs. An actual count of a specimen having twelve forks shows the terminal twigs to be about 5,470, or little more than one-fourth the number called for by the theory. (See Table I.)

The question rises; what rule is observed in the forking? When a shaft splits in two at its tip there result two branches, and these again splitting would give four branches. But if the primitive shaft — instead of making an equal split, continued its growth in a direct line and only threw off simple twigs to the right and left, the number of twigs, instead of doubling at each forking, would increase in no greater ratio than the forks themselves. Thus a shaft that split equally eight times would have 128 twigs; whereas a shaft with eight lateral forks would present only nine terminal twigs.

The first mode is dichotomous or forking; and the second axial or trunk-growth.

In dichotomous growth the *tip* of the axis, trunk, or shaft splits in two. In axial growth the trunk continues to extend, and from time to time sends out side branches from points *below* the tip. Dichotomy (the only growth that concerns *Astrophytons*) may have several types. 1. The shaft may split in two equal halves; these in four; the four in eight; the eight in sixteen, and so on. And if the dis-

TABLE I.

Total forks in left branches from stem.	Number of forks of branches in their order from main stem.										Order of left branches from stem.	Order of right branches from stem.	Number of forks of branches in their order from main stem.										Total forks in right branches from stem.
	12	11	10	9	8	7	6	5	4	3			3	4	5	6	7	8	9	10	11	12	
2	1	·	·	·	·	·	·	·	·	·	11th												
												10th	·	·	·	·	·	·	·	·	1	2	4
6	2	2	1	·	·	·	·	·	·	·	9th												
												8th	·	·	·	·	·	·	1	2	1	·	5
19	5	6	4	2	1	·	·	·	·	·	7th												
												6th	·	·	·	·	1	2	4	8	16	7	39
38	4	8	10	8	4	2	1	·	·	·	5th												
												4th	·	·	1	2	4	8	14	26	28	9	93
113	1	16	34	30	16	8	4	2	1	·	3d												
												2d	1	2	4	8	16	31	61	68	35	·	227
178	13	32	49	40	21	10	5	2	1	·			1	2	5	10	21	41	80	108	81	18	368
																				And forks of left side			178
																				Total forks in one half an arm (right stem)			546

Astrophyton Agassizii (see plate 5) table to exhibit the number of forks in one stem (or one half an arm). Thus, the 2d fork of the arm, on the right side of this *right hand stem* has, in its development 227 forks included between the 2d and 12th forks as counted from the disk. Such a stem is formed by the strong prongs of the successive forks. See plate 7, fig. 3.) The total forks of the main stem and of its branches, on the right and left being 546, the entire number of forks for the five arms would be 5,465 (in the same proportion) and the number of terminal twigs 5,470.

tances between the forks are everywhere the same, there results the perfect type of equal forking (Plate 7, fig. 6), a symmetrical figure corresponding to Winthrop's theory of branching. 2. When the shaft splits or forks, it may form two prongs or branches of different size; one strong, the other weak. If the weak prong in consecutive forkings is on opposite sides, alternating right and left, and the distances between the forkings are equal; and if the strong prongs keep the same direction and make together a straight line, there results a figure with a straight central shaft which imitates an axial growth. It may be called *equal alternate straight forking*,[1] and is illustrated by

[1] Dichotomie sympodique heliçoide: Sachs, Traité de Botanique. pp. 217, 219.

Selaginella among the club mosses, which branches in one plane (Plate 7, fig. 5). 3. If the strong prongs alternate right and left, and if the distances between the forks are unequal, there results *unequal alternate forking* (Plate 7, figs. 1, 2, 3, 4), and this is the type of *Astrophyton*, where the strong prongs usually form a nearly straight stem, though sometimes a more or less pronounced zig-zag.

An inspection of the terminal twigs of an adult *Astrophyton*, or of the arms of a young specimen, will show that the attempt at first is towards a fork with equal prongs; and the arm-bone at that point is found broadened into two equal faces corresponding to the prongs. Presently one prong gets larger than the other, and thenceforth maintains its superiority, although both continue to lengthen and to make new forks. At every fork, therefore, there is a strong and a weak prong; and these succeed each other in *alternation*; that is to say, if the second fork has the right prong strong, the third will have the left prong strong; the fourth, the right again, and so on.

The first fork of an adult, lying near the edge of the disk, seems to split the arm in equal halves; but the arm of a young specimen shows that even in this case one prong is stronger than the other, and grows more rapidly (Plate 7, fig. 1). Plates 4, 5 and 6 show the development of the right-hand prong or stem from the first fork in the arms of *Astrophyton costosum*, *Agassizii* and *asperum*. At the second fork the stem throws a strong branch to the right, especially conspicuous in *costosum*, where it furnishes two hundred and fifty-three forks in a total of ten hundred and twenty-four (Table II), and in *Agassizii*, where it has two hundred and twenty-seven out of five hundred forty-six (Table I). The inner branches having had a longer time to grow, naturally show more forks, but not invariably; thus *A. asperum* has more in the tenth branch than in the ninth (Pl. 6).

The number of joints in the shaft from one fork to another cannot increase, but their bulk increases very much. If a very small *A. Agassizii* with a disk 2.2 mm. in diameter, and forks only to the second order in each arm, be compared with a large specimen having a disk of 70 mm., and arm-forks to the twelfth order, it will be found that the length of the shaft between the first and second forks increases about twelve times, and its width thirty times, while the number of joints remains the same. In this proportion a single adult joint would occupy nearly double the length filled by all the young joints, which gives an idea of the constant and rapid change taking place in the arm during the life of the animal.

TABLE II.

Total forks in left branches from stem.	Number of forks of branches in their order from main stem. 26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	Order of left branches from stem.
2	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	25th
4	·	2	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	23d
7	·	3	2	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	21st
23	·	4	4	7	4	2	1		·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	19th
49	2	7	5	9	10	8	4	2	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	17th
45	·	·	·	4	4	11	11	7	4	2	1	·	·	·	·	·	·	·	·	·	·	·	·	·	15th
61	·	·	·	·	3	11	8	12	11	8	4	2	1	·	·	·	·	·	·	·	·	·	·	·	13th
56	·	·	·	·	·	·	1	6	12	11	10	8	4	2	1	·	·	·	·	·	·	·	·	·	11th
49	·	·	·	·	·	·	·	·	4	8	8	9	8	5	3	2	1	·	·	·	·	·	·	·	9th
46	·	·	·	·	·	·	·	·	·	·	4	8	6	8	7	5	4	2	1	·	·	·	·	·	7th
32	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2	6	10	6	4	2	1	·	·	·	5th
40	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2	3	3	5	11	8	4	2	1	·	3d
414	3	16	12	21	21	32	25	27	32	29	27	27	19	15	15	16	18	13	16	10	5	2	1	·	

Order of right branches from stem.	Number of forks of branches in their order from main stem. 3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Total forks in right branches from stem.
24th	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	1	3
22d	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	2	3	·	7
20th	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	2	4	2	·	·	10
18th	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	2	4	6	6	2	·	·	22
16th	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	2	4	4	7	6	5	2	·	·	32
14th	·	·	·	·	·	·	·	·	·	·	·	·	1	2	4	8	10	11	9	4	2	·	·	·	52
12th	·	·	·	·	·	·	·	·	·	·	1	2	4	8	6	8	5	9	5	·	·	·	·	·	49
10th	·	·	·	·	·	·	·	·	1	2	4	8	9	8	5	2	·	·	·	·	·	·	·	·	40
8th	·	·	·	·	·	·	1	2	4	6	12	14	14	11	4	·	·	·	·	·	·	·	·	·	69
6th	·	·	·	·	1	2	4	6	6	10	9	4	·	·	·	·	·	·	·	·	·	·	·	·	43
4th	·	·	·	2	4	8	9	3	2	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	30
2d	1	2	4	8	16	32	44	39	34	22	13	10	9	5	2	3	2	2	2	2	·	·	·	·	253
	1	2	4	10	21	42	58	50	47	41	39	38	37	34	22	23	22	28	28	20	18	8	4	1	610
																								And forks of left side	414
																								Total forks in one half an arm (right side)	1,024

Astrophyton costosum (see plate 4) table to exhibit the number of forks in one stem (one half an arm). Thus, the 2d fork of the arm on the right side of this *right hand stem* has, in its development, 253 forks, included between the 2d and 22d forks, counted from the disk, namely, 1 of the 2d and 3d order, 2 of the 4th, 8 of the 5th, and so on. The total forks of the main stem and of its branches, on the right and left, being 1,024. The entire number of forks for the five arms would be 10,245 (in the same proportion), and the number of terminal twigs 10,250.

On comparing the distance between the forks of the three species, or, in other words, the lengths of the shafts, it will be seen that although they branch according to the same rule, they follow three types or patterns, which depend on the relative lengths of the shafts or parts of the arm lying between the forks. (See Table III.)[1] *A. costosum* begins with shafts of 9 mm., which diminish to 5 mm. at the ninth fork, and to 3 mm. at the sixteenth, which number continues to the end, or twenty-sixth fork, and the average length of the shafts for the half-arm is only 4.7 mm. *A. Agasizii* begins with shafts of 27 mm., which diminish to 14 mm. at the eighth fork, and to 8 mm. at the last fork (twelfth). The average is 16.4 mm., or nearly four times that of *A. costosum*. *A. asperum* beginning with 12 mm., a shaft longer than that of *A. costosum*, suddenly diminishes to 4 mm. at the seventh fork, then to 2 mm. at the ninth, and 1 mm. at the twelfth, which is constant to the end (eighteenth). The general average is only 3.5 mm., considerably less than in *A. costosum*. To summarize the three types, we may call that of *A. costosum* a branching, with numerous short, nearly equal shafts (Plate 7, fig. 2); of *Agassizii*, few, long, unequal shafts (Plate 7, fig. 3); of *A. asperum*, numerous short, suddenly diminishing shafts (Fig. 4).

These three types of branching correspond to as many differences of structure and locality. *A. costosum* makes a group with *A. spinosum* and *A. cacaoticum*, characterized by an arm very broad at its base, and supported by a small disk with re-entering curves. The habitat is in the warm waters on either side of Central America. The second group includes all the species of the colder seas, such as *A. Agassizii*, *A. eucnemis*, *A. Stimpsonii*, and *A. Pourtalesii*. The disk is rounded and large, and the arms narrow at their origin. *A. asperum* inhabits the Indian Ocean, and constitutes by itself the third group, well marked by its short terminal twigs, which give a look like moss to the periphery of the animal.

One characteristic observable among Astrophytidae is the exaggerated development of the arms. *Astrogomphus* among the simple-armed Astrophytons shows proportionately the widest disk, whose diameter goes six times into the length of the arm. *Astroschema* has an arm more than thirty times the disk.

But these proportions are trifling compared with those of *Astrophyton* itself. If the lengths of all the branches and twigs of an arm

[1] The numbers in Table III, compared with corresponding ones in Tables I and II, differ a little, because different stems were measured.

TABLE III.

Astrophyton costosum.
Synopsis of right-hand stem (one half arm)

Number of forks.	Order of forks counted from disk.	Average length of shafts between forks.
		mm.
2	2d–3d	9
4	3d–4th	9
8	4th–5th	9
16	5th–6th	8
32	6th–7th	7
59	7th–8th	6
74	8th–9th	5
74	9th–10th	5
64	10th–11th	5
58	11th–12th	5
59	12th–13th	4
63	13th–14th	4
72	14th–15th	4
76	15th–16th	3
52	16th–17th	3
65	17th–18th	3
62	18th–19th	3
53	19th–20th	3
62	20th–21st	3
49	21st–22d	3
44	22d–23d	3
23	23d–24th	3
18	24th–25th	3
5	25th–26th	3

24)113(4.7 mm. average length of fork for whole branch.

Astrophyton Agassizii.
Synopsis of right-hand stem (one half arm).

Number of forks.	Order of forks counted from disk.	Average length of shafts between forks.
		mm.
2	2d–3d	27
4	3d–4th	27
8	4th–5th	21
16	5th–6th	19
32	6th–7th	17
63	7th–8th	14
121	8th–9th	11
157	9th–10th	11
115	10th–11th	9
13	11th–12th	8

10)164(16.4 mm. average length of fork for whole branch.

Astrophyton asperum.
Synopsis of right-hand branch at 2d fork from stem.

Number of forks.	Order of forks counted from disk.	Average length of shafts between forks.
		mm.
1	2d–3d	12
2	3d–4th	10
4	4th–5th	9
8	5th–6th	6
16	6th–7th	4
32	7th–8th	3
64	8th–9th	2
115	9th–10th	2
123	10th–11th	2
149	11th–12th	1
133	12th–13th	1
65	13th–14th	1
64	14th–15th	1
27	15th–16th	1
8	16th–17th	1
4	17th–18th	1

16)57(3.5 mm. average length of fork for whole branch.

be added, so as to represent a single line, it will be found that the combined length in *A. Agassizii* is about one hundred and eighty-four times the diameter of the disk; and in *A. costosum* about two hundred and fifty-eight times. In other words, a specimen of *A. costosum*, whose disk was less than one and one-half inches across, would have an arm thirty feet long.

Using the same unit, the arm of *Ophiothrix longipeda* — (the longest armed species among Ophiothrix) would measure only two feet and three inches.[1]

Description of Plates.

Plate 4. *Astrophyton costosum* Seba. Diagram of the right-hand stem (one-half an arm) carried out to its last forks. Each shaft in this and the two succeeding plates has been measured separately, and is drawn in proper proportion. The figures indicate the order of the forks as counted from the disk.

Plate 5. *Astrophyton Agassizii* Stimpson. The same treatment as in Plate 4.

Plate 6. *Astrophyton asperum* Agass. The same treatment, except that only the right-hand branch, at fork two, is carried out to its ultimate forks. It was not possible to unroll and measure the mass of fine twigs which composed the rest of the half arm.

Plate 7. Diagrams of different forkings. Fig. 1. A young *A. Agassizii*, from nature. Fig. 2. Type of *A. costosum*. Fig. 3. Type of *A. Agassizii*. Fig. 4. Type of *A. asperum*. Fig. 5. Forking of the club-moss *Selaginella*. Fig. 6. Type of regular dichotomy.

The Librarian announced the gift of a large number of valuable books, chiefly botanical, from the Hon. George B. Emerson, to whom the thanks of the Society were voted.

[1] Since writing the above, I have had the opportunity of examining the arms of *A. verrucosum*, on which Agassiz wrote his valuable monograph. (Sur quelques points de l'organisation des Euryales. Mém. de la Soc. Sc. Nat. Neuchatel, II, 1839.) The disk was 80 mm. in diameter. Starting at fork two of the right branch, the left stem is remarkable for poverty of twigs; the right for abundance. Thus the twig at fork thirteen of the *left* stem has but three forks; that of fork thirteen of the *right* stem has about three hundred. The whole number of forkings from the main (right) stem is thirty-five; and some of the outer twigs (*e. g.*, at fork thirteen) have more forks than the inner (*e. g.*, at fork five). Agassiz's plate was drawn from a small, dry specimen, and the finer twigs could not be represented in detail.

General Meeting. March 21, 1877.

The President, Mr. T. T. Bouvé, in the chair. Twenty-seven persons present.

The following paper was read:

Notes on some of the Birds found in Southeastern Oregon, particularly in the Vicinity of Camp Harney, from November, 1874, to January, 1877. By Captain Ch. Bendire, U. S. Army.

This list is not given as a complete exponent of the avi-fauna of Southeastern Oregon. I am well aware that there still remain many species to be added, particularly of water birds. As far as it goes, it has been compiled from material now in the hands of Lt. G. R. Bacon, U. S. A., and from personal observations. Camp Harney (the central point of my investigations) is located on the southern slope of one of the western spurs of the Blue Mountains of Oregon, at an altitude of about 4800 feet in 43° 80′ latitude, and 41° 25′ longitude, west of Washington. To the north of the post the country is mountainous and generally well-timbered with forests of pine, spruce and fir, and groves of aspens and junipers; in all other directions it is almost destitute of trees of any size, a few straggling juniper and mountain mahogany bushes being sparingly distributed over the different mountain ranges. The highest and most important of these is Steen's Mountain, about seventy miles to the south of the post, portions of which range are covered with snow the year round. Excepting a few warm and fertile river valleys, nearly the whole extent of country is unfit for agriculture. About two-thirds of it is covered with sagebrush and greasewood wastes, volcanic table-lands, etc., the balance with nutritious grasses, and well adapted for stock-raising purposes. As a general thing, the country may be called well watered throughout; a continuous chain of shallow lakes extends from here to the southwest for more than two hundred miles, and some of these are from ten to twenty miles wide and thirty to fifty miles in length. The water in most of them is brackish, and barely fit to drink. Fine springs, both hot and cold, are also numerous. The many lakes form a natural highway and convenient resting places for the immense hordes of water fowl passing through here during the spring and fall migrations; they also furnish safe and undisturbed breeding resorts for many species. The climate, generally speaking, may be called mild. In the higher mountain valleys it is almost arctic, ice being formed there even in midsummer; and many species of birds breed there which generally go much farther north for this purpose.

1. Turdus nanus (Aud.). The Dwarf Hermit Thrush.

Apparently rare. On June 28, 1875, I found a nest of this species containing three young nearly fledged, and an addled egg. The nest was placed on the ground under a laurel bush in a ravine near the head of Rattlesnake Creek, a few miles from Camp Harney, Oregon. The egg is pale green, measuring .89 × .65 of an inch, and unspotted.

2. Turdus migratorius (Linn.). Robin.

An abundant summer resident, breeding in great numbers in this vicinity. A few pass the milder winters here, frequenting at such times the junipers, whose berries furnish them their principal food; they are undoubtedly birds which have been reared farther north.

3. Turdus nævius (Gmel.). Varied Thrush.

Rare. A single specimen of this species was shot by Lieut. G. R. Bacon, U. S. A., March 7, 1876, a fine male. He found it amongst the shrubbery on Rattlesnake Creek, a short distance from Camp Harney, amongst a number of the common robin, evidently a straggler, as it was the only one seen.

4. Oreoscoptes montanus (Baird). Mountain Mocker.

A common summer resident. This species is one of the earliest birds to arrive in the spring, and its presence is easily detected by its superb song. I find this bird both on the large sagebrush plains and in the small valleys on the summit of the Blue Mountains at an altitude of over six thousand feet, but not so common as in the lower Harney valley. It nests in various bushes, principally, however, in sage and serviceberry bushes, and appears to prefer sunny hillsides for this purpose. It commences to lay here about the end of April; usual number of eggs four, occasionally five. The average measurement of their eggs is 0.95 × 0.70 of an inch. There is but little variation in either the ground color or markings of their eggs. I believe that two broods are raised in a season. They leave here about the middle of September. I found them common during the winter months in Southern Arizona.

5. Cinclus mexicanus (Swains.). Water Ouzel.

Rare. I took a single specimen (♀) of this species Feb. 18, 1875, on Rattlesnake Creek. It does not breed in this vicinity, but, on the northern slope of the Blue Mountains, is quite common.

6. **Sialia mexicana** (Swains.). California Bluebird.

Common during their migrations; none are known to remain to breed, but appear to move further to the north.

7. **Sialia arctica** (Swains.). Rocky Mountain Bluebird.

This species breeds here, but is not common. In the vicinity of Canyon City, Oregon, I found this species rather abundant, breeding in old decayed pine stumps and deserted holes of woodpeckers. Usual number of eggs five and six. Average measurement of fifteen specimens .84 × .62. There is a good deal of variation in the color of these eggs; some are very bright bluish green, others of a very pale greenish color. The birds commence to nest about May 20, and probably raise two broods a season. None appear to nest about houses; they are shy, and confine themselves to the pine forests and juniper groves on the mountains. I have noticed a few as late as Nov. 15.

8. **Regulus satrapa** (Licht.). Golden-crowned Kinglet.

I saw a few specimens Nov. 7, 1875, feeding among the alders and willows on Rattlesnake Creek, and occasionally afterwards. They are, however, not common.

9. **Regulus calendula** (Licht.). Ruby-crowned Kinglet.

This species undoubtedly breeds about here, as I have seen it during the summer in the dark spruce forests in the Blue Mountains, at an altitude of sixty-one hundred feet, but have been unable to find its nest. A number remain amongst the willows and alders on the creek bottom during the winter, in company with *Parus montanus* and *P. atricapillus*, var. *occidentalis*. It is a lively bird and a fair songster.

10. **Parus montanus** (Gambel). Mountain Chickadee.

Common during the winter months, in the willows and shrubbery near the creeks. In the summer they breed on the higher mountains, but are not found in the lower valleys. On June 8, 1876, while hunting for nests of *Sialia artica* on the summit of the Canyon City mountain, I struck an old pine stump with a hatchet, and a bird of this species flew out of a hole and perched on a small willow bush close by, giving me a good opportunity to identify it. I found a single egg at the bottom of the hole on some finely powdered wood, but no nest. The ground color is clear white, and the egg is uniformly spotted with a pale reddish brown. Size .58 × .49 of an inch. It was perfectly fresh.

11. Parus occidentalis (Baird). Western Chickadee.

Common during the winter months, frequenting the same places as the preceding species, and retiring to the neighboring mountains to breed.

12. Psaltriparus minimus var. **plumbeus** (Baird). Lead-colored Bush-titmouse.

A summer visitor, not abundant. I shot several specimens of this species in Nov., 1874, while they were feeding amongst the alders and willows on the creek, in company with *Parus occidentalis* and *Regulus calendula.* Measurements of one: length 4.25, wing 2.10, tail 2.25. In June, 1876, I saw several near the summit of the Canyon City mountain, evidently breeding.

13. Sitta aculeata (Cassin). Slender-billed Nuthatch.

This is a moderately abundant species in the pine forests of the Blue Mountains, and resident throughout the year. A set of eggs of this variety average .70 × .55 of an inch, and are clear white, with reddish brown spots generally distributed over the entire surface of the egg. The set was obtained June 6, 1876.

14. Sitta pygmæa (Vig.). Pigmy Nuthatch.

A moderately abundant summer resident in the Blue Mountains; a few remain throughout the year. Nests like the preceding species in holes in decayed pine trees; the cavity is usually partly filled with small sticks, and on these the nest of fine strips of bark, principally juniper, and lined with feathers, is placed.

15. Salpinctes obsoletus (Cabanis). The Rock Wren.

A common summer resident, found wherever there is a ledge of rocks. It is one of the earliest birds in the spring, and one of the latest in fall. Its nests are generally placed under loose rocks, and therefore hard to find. The usual number of eggs laid is seven. Their ground color is pure white, and they are marked with small reddish brown spots, sparingly distributed over the entire egg. Their shape varies a great deal. Measurements of three eggs, each from a different nest, are as follows: .76 × .58, .72 × .55, and .67 × .56 of an inch. The nest itself is a slight affair, composed of sticks and bark, lined with a few fine roots, feathers and hair. They probably raise two broods a year. They are cheerful and active, and the male during the breeding season is brimful of song. Their nests are very artfully concealed. A pair had a nest within eighty yards of my house, for which I looked almost daily, but they reared their young to almost full size before I found them, and although I searched more than once within a foot the old birds seemed perfectly unconcerned, perched on a rock within a few feet of me, flipping their tails up and down, as if in derision at my vain attempts to find their nest. They rarely come about houses.

16. Thryothorus bewickii var. **spilurus** (Vigors).

Rather rare in this vicinity. Eggs of this variety from California are scarcely distinguishable from specimens of the eastern variety *bewickii*. They are pure white, sparingly dotted with very fine spots of pale red and lilac, principally about the larger end. Three eggs, each one from a different nest, measure as follows: .61 × .50, .61 × .49, .66 × .50 of an inch.

17. Troglodytes parkmanni (Aud.). Parkman's Wren.

A very common summer resident, abundant wherever there is any timber, to which it seems to confine itself. It commences nesting about June 1, and places its nests sometimes in very curious situations. I have found several between the bark and the wood of old rotten pine stumps, and one in a bundle of dry deer skins hanging over the door of a woodchopper's cabin.

18. Cistothorus palustris var. **paludicola** (Baird). Long-billed Marsh Wren.

An abundant summer resident. A few winter here.

19. Anthus ludovicianus (Licht.). Titlark.

Very abundant on the barren flats bordering Malheur Lake during the migrations, and in very large flocks.

20. Helminthophaga celata (Baird). Orange-crowned Warbler.

Common during the migrations; a few may remain to breed. Eggs of the variety *lutescens* Ridg., from California, are white with a faint pinkish tint, and spotted principally about the larger end with fine dots of reddish brown and lavender. Size of three eggs, each one from a different nest, .60 × .50, .65 × .46, .63 × .50 of an inch.

21. Dendroica æstiva (Baird). Summer Yellowbird.

A very common summer resident, breeding abundantly among the shrubbery along the streams. It commences nesting about June 1.

22. Dendroica auduboni (Baird). Audubon's Warbler.

An abundant species during the spring migration. Arrives here about May 1. None seen in the fall. A few remain to breed in the Blue Mountains. Specimens shot between May 2 and 5, 1876.

23. Dendroica nigrescens (Baird). Black-throated Gray Warbler.

Observed on several occasions near the summit of the Canyon City mountain during the early part of the summer of 1876.

24. Dendroica townsendi (Baird). Townsend's Warbler.

Rare, a specimen obtained May 11, 1875. I took a nest and three eggs June 7, 1875, which, I believe, belongs to this species. It was very neatly constructed of rotten plant fibres, roots, and lined with very fine rootlets, a little hair and down from cottonwood seeds. The nest was placed in a narrow ravine near the head of Rattlesnake Creek, amongst several small willow shoots near the main stem, and about four feet from the ground. The specimen shot was obtained in the same neighborhood, but I failed to secure the parent of the eggs, although I saw the birds several times. They were moving constantly in the densest undergrowth, and it was difficult to shoot them. The eggs are pyriform in shape, pinkish white, with spots of light brown and lavender, and dark amber, principally around the larger end. Measurement, $.62 \times .50$, $.60 \times .50$, $.61 \times .51$ of an inch. They do not resemble any other warbler's eggs in my collection.

25. Geothlypis macgillivrayi (Baird). Macgillivray's Ground Warbler.

A common summer resident, breeds. It arrives here about May 1, and frequents the thickest undergrowth along the creek bottoms. A nest containing four eggs was taken June 15, 1875. It had been placed between several stems of a wild rosebush about an inch from the ground, on a layer of dead leaves. Measurements of eggs, $.71 \times .52$, $.70 \times .54$, $.74 \times .51$ and $.70 \times .50$.

26. Icteria virens var. **longicauda** (Lawrence). Long-tailed Chat.

A rare summer resident in the vicinity of Camp Harney; arrives about May 15. A single set of eggs of this species I found June 5, 1876. Eggs of this species collected near Ft. Lapwai, Idaho, are nearly as large again as many taken in the vicinity of Tucson, A. T.

27. Petrochelidon lunifrons (Baird). Cliff Swallow.

One of the most abundant summer residents in this section of country. Their nests can be seen on almost any of the numerous perpendicular cliffs in this vicinity. Many of them breed under the eaves of the buildings of the post. They arrive about the commencement of May, and leave about the middle of August.

28. Hirundo horreorum (Barton). Barn Swallow.

Rather rare, a few pairs breed about the buildings of the post. They arrive about the same time, but remain longer than the former.

29. Hirundo thalassina (Swains.). Violet-green Swallow.

Noticed on Bear Creek, near the summit of the Blue Mountains, in the summer of 1876.

30. Cotyle riparia (Boie). Bank Swallow.

Breeds in large numbers on one of the islands in Malheur Lake, in the side of a perpendicular ridge from four to six feet high. The soil is sandy, and the burrows extend in from two to five feet. Some of the eggs had been set on for a week when taken on May 27, 1875, and one of the nests contained seven eggs, the majority five or less.

31. Vireosylvia swainsoni Baird. Western Warbling Greenlet.

Specimens seen on but two occasions in June, 1876.

32. Ampelis garrulus (Linn.). Northern Waxwing.

A winter visitor. First noticed Nov. 23, 1875, amongst the willows bordering Silvies River, Oregon. Quite a number were secured between Nov., 1875, and March 1, 1876. During their stay here they fed exclusively on the berries of the wild rose, and became excessively fat. The sexes, in mature specimens, are exactly alike, as far as the markings of the primaries are concerned. The white in the female is carried around the terminal edge of the inner webs of primaries as well as in the male. The black on the chin and throat of the females is somewhat paler than in the males. See my article in "Forest and Stream," Vol. VI, No. 2, Feb. 17, 1876.

33. Myiadestes townsendi (Cab.). Townsend's Solitaire.

Rather common among the juniper groves during spring and fall, and in mild winters throughout the whole season. None remain here during the breeding season. (See Proceedings of Boston Society of Natural History, Vol. XVIII, p. 155, Oct. 6, 1875.)

34. Collurio borealis (Baird). Great Northern Shrike.

A rare winter visitor. I took two specimens Jan. 5, 1876, both young birds, following a number of Oregon snow birds.

35. Collurio ludovicianus var. **excubitoroides** (Baird).

A common summer visitor, and generally distributed. They arrive here about the 20th of March, and commence nesting about the middle of May. May 22, 1876, I found two of their nests in serviceberry bushes, not twenty feet from each other. The nests were very deep, but the walls of the nest rather thin, well constructed, however, and warmly lined with hair and feathers. The usual number of eggs found by me in a nest was six. In Arizona they laid but four.

36. Pinicola enucleator (Cabanis). Pine Grosbeak.

An occasional winter visitor. On Dec. 5, 1875, quite a flock appeared amongst the willow and alder bushes along Rattlesnake Creek, and remained for several days. The only note I heard them utter was *wui-whit*. But few full plumaged males were seen.

37. Carpodacus cassini (Baird). Cassin's Purple Finch.

A moderately abundant summer visitor; breeds in the pine forests of the Blue Mountains. The song of these birds is delightful. In 1874 I took specimens in the early part of Dec., and it is probable that some remain throughout mild winters.

38. Carpodacus frontalis (Sclater). House Linnet.

April 8, 1876, I shot a single specimen, a young male.

39. Chrysomitris tristis (Bonap.). Goldfinch.

Seen on but a single occasion, May 5, 1876, when I observed a small flock amongst the willows on Rattlesnake Creek.

40. Chrysomitris pinus (Bonap.). Pine Goldfinch.

Common during the winter months in the pine forests of the Blue Mountains; have seen them in large flocks at different times, but believe they breed further north, as I have not seen any during the summer.

41. Loxia curvirostra var. **americana** (Baird). Red Crossbill.

Common during the winter months, occurring in large flocks, generally frequenting the highest pines. While flying from tree to tree they utter a shrill, peculiar call-note. I have seen this species, still in large flocks, in the latter part of February in the winters of 1875 and 1876, and found the ovaries in three females yet in a normal condition.

42. Ægiothus linarius (Caban's). Lesser Red-Poll.

Found in large flocks during the winter months, feeding amongst the shrubbery on the creek bottoms. They are quite tame and unsuspicious, allowing me to come within a few feet. In their movements they resemble Titmice, and seem to hang as easily on a small twig, head downward, as in any other way. They are active, quick in their movements, and very quarrelsome, and keep up a constant twittering.

43. Leucosticte tephrocotis (Swainson). Gray-crowned Finch.

A winter visitor, associated with *L. littoralis*. During the winter of 1875–6, I took a number of this species at different times, from Nov. 8, 1875 to March 22, 1876. The sexes differ in coloration, the brown of the breast in the males, and the red tints generally are much brighter than in the females.

44. Leucosticte littoralis (Baird). Hepburn's Finch.

This species is much more common here during the winter than the preceding, in proportion of about six to one. I have observed these birds almost daily for two winters, and examined about two hundred specimens by dissection, and find that there is a constant difference in the coloration of the sexes. The brightest colored females are easily distinguished from the dullest colored males, and there is also an appreciable difference in the size between the sexes. As Prof. J. A. Allen has demonstrated these points fully, I refer to his article.[1] In their habits these birds are terrestrial, seldom alighting on trees or bushes. Their usual call-note when lost from the flock is *aetch*, *aetch*, when on the wing *yu-hi-wea*, and *whi*, *hi*. Their flight is undulating and waving, somewhat resembling that of *Colaptes mexicanus*. When on the ground their wings are usually trailed. Their food consists principally of the seeds of Artemisia (Sagebush), minute plants found on side hills not covered with snow, grass seeds, and grain found about stables. About the middle of March, 1876, I trapped a number, but they rapidly pined, and several died; I liberated the balance. An egg kindly sent to me by a gentleman living near Steen's Mountain (a high range about seventy miles to the south of Camp Harney, and almost destitute of timber), the summit of which is covered, in parts, with snow the year around, may belong to this species. It is dull white in color, .85 × .65 of an inch in length, considerably pointed at one end, and was found in a nest on the ground near the summit of the mountain, in the latter part of June, 1875. The nest contained five eggs. It is probable that some of this species breed on the high mountain peaks in this vicinity, and that the majority go further north.

45. Plectrophanes nivalis (Meyer). Snow Bunting.

Found sparingly in the vicinity of Camp Harney, Oregon, during the winter months.

[1] See article by Prof. J. A. Allen, in "Bulletin of the Geological and Geographical Survey of the Territories." Vol. II, No. 4. Washington, July 1, 1876.

46. **Plectrophanes lapponicus** (Selby). Lapland Longspur.

The same remarks apply to this species, but both species are probably more common in the lower Harney valley.

47. **Centronyx bairdii** (Baird). Baird's Bunting.

May 24, 1876, I took a nest and four eggs with the parent, which I identified as belonging to this species. The nest was composed externally of old sagebush bark and grasses, and lined with finer materials of the same kind and a few hairs. It was partly concealed under a bunch of tall grass, and found on the flat about five miles below Camp Harney, on the edge of a swampy meadow. The eggs are an elongated oval in shape, ground color a very pale green, three of the eggs marked with irregular spots, lines and blotches of two shades of brown (light and dark), and a few lavender spots. The fourth is blotched throughout with a pale pinkish brown. In the first three eggs the markings are principally about the larger end. Size, $.72 \times .55$, $.74 \times .56$, $.71 \times .54$ and $.74 \times .54$.

48. **Passerculus alaudinus** (Bonap.). Western Savanna Sparrow.

Very common in the early spring along the meadows and swamps bordering Malheur Lake. They arrive about April 1. At this season the males may be found sitting on the top of low greasewood bushes uttering their feeble song. Five specimens shot April 23, 1876, were all males.

49. **Poocætes gramineus** var. **confinis** (Baird). Grass Sparrow.

A very common summer resident in this section, breeding abundantly.

50. **Chondestes grammaca** (Bonap.). Lark Sparrow.

In the immediate vicinity of Camp Harney few specimens of this species were found. I shot a male on May 6, 1876, amongst the willows on the creek. None breed about here. At Juniper Lake, about eighty miles south of this post, I found quite a number breeding in July, 1876, and all had young. The song of this bird is exquisite.

51. **Zonotrichia Gambeli** (Gambel). Western White-crowned Sparrow.

A moderately abundant summer resident. I have found two of their nests, one placed on the ground at the base of a sagebush, the other in a small sagebush about a foot from the ground.

52. **Junco oregonus** (Sclater). Oregon Snowbird.

A winter resident, retiring to the neighboring mountains in the summer. I have seen a few of these birds near the summit of the Canyon City mountains in June, 1876, where they undoubtedly breed. It is a very familiar species, a number keeping constantly about the houses in the post during the winter, many appropriating the old nests of cliff swallows for roosting plaees.

53. Poospiza belli var. **nevadensis** (Ridg.). Artemisia Sparrow.

A not very abundant summer resident, breeding on the sage plains south of the post. None remain through the winter.

54. Spizella monticola (Baird). Tree Sparrow.

Moderately abundant during the winter months, feeding amongst the shrubbery on the creek bottom, near the post.

55. Spizella breweri (Cassin). Brewer's Sparrow.

A common summer resident. Breeds abundantly amongst the sagebrush covered plains in the vicinity of water. Their eggs show a great deal of variation in shape and size, as well as in their markings. Some are but slightly pointed at the smaller end, others pyriform, and others again of an elongated oval. Ground color a pale bluish green, spotted irregularly, principally about the larger end, so as to form a ring in many cases. Size of eggs from different nests, $.70 \times .50$, $.68 \times .48$, $.63 \times .49$, $.60 \times .46$, $.59 \times .46$.

56. Melospiza melodia var. **fallax** ?

The race found here, a resident (partly, at least) throughout the year, is, according to Mr. Lawrence, referable to *fallax*.[1] It is found among the willows on the creeks, where it also constructs its nest.

57. Melospiza melodia var. **rufina** (Baird). Rusty Song Sparrow.

In December, 1875, I took two specimens belonging to this race. They are much darker than specimens of the former, but are perhaps the true var. *guttata.*

58. Melospiza lincolni (Baird). Lincoln's Finch.

Noticed in the spring of 1876, in considerable numbers on their way north, amongst the willows on Rattlesnake Creek, associated with a number of Gambel's finches and Slate-colored sparrows. A few remain to breed.[2]

[1] Mr. Ridgway regards it as approaching *guttata*. Its eggs resemble those of *fallax*.

[2] *Peucæa ruficeps* Baird is not included in this list for the reason that no specimen has been taken. An unidentified nest with eggs has been conjecturally referred to this species, but thus far without positive proof, and no specimen of the bird has been obtained.

59. Passerella townsendi var. **schistacea** (Baird). Slate-colored Sparrow.

A common summer visitor; arrives about April 1. Their presence is easily detected from the noise they make scratching among the fallen leaves among the bushes in the creek bottoms. Their call-note then is a faint *tzip*. It is very gentle and unsuspicious, preferring to breed in the vicinity of houses rather than at a distance. I have found some twenty of their nests within half a mile of either side of the post, in fact none, or very few, breed on Rattlesnake Creek at a greater distance from it, either above or below the post. The nest is usually placed in a dense willow or rose thicket, close to water, from one to three feet from the ground. It is compactly constructed, larger than nests of Melospizæ, and, as a rule, deeper. It is composed of bark and grasses externally. These materials are damp when first used, and are solidly worked into each other; the inner lining consists of fine grasses, and usually some horsehair. The eggs are four in number, seldom more; their ground color is a bright green, and they are spotted principally about the larger end, with two shades of brown, and some specimens also with lavender. There is considerable difference in the amount of markings in eggs of different nests. The average size of fourteen sets of eggs in my collection is .87 × .64 of an inch. Compared with eggs of *P. iliaca* from Labrador, I find a radical and constant difference both in the ground color, which is much paler, and particularly in the style and color of the markings. Both are entirely different. In the eggs of *P. iliaca* the ground color is almost hidden by the markings. These are evenly distributed over the entire egg, of a light rusty brown color, giving the egg a reddish brown appearance. In over fifty specimens of the var. *schistacea* there is not a single egg resembling the six I have of *P. iliaca*. These were selected out of a number by Dr. T. M. Brewer, of Boston, Mass., and kindly sent to me for comparison. On the other hand, the eggs of the *Passerella townsendi* (Nut.) collected on Vancouver Island, B. C., by one of my correspondents, are not distinguishable from those of the var. *schistacea* found here. In the early spring the males of this species are often seen perched on the top of some dead twig singing. Their song, however, is very feeble.

60. Hedymeles melanocephalus (Swain.). Black-headed Grosbeak.

A rare summer visitor. I have found two nests with eggs, in the seasons of 1875 and '76. It begins to breed here about June 1. The male is a superb singer, and as he generally sings only in close proximity to the nest (he delights to perch on a dead twig in the tops of the tallest willows growing nearest to the nest) he often betrays it thereby. I found this species breeding near Fort Lapwai, Idaho, in 1871.

61. **Cyanospiza amœna** (Baird). Lazuli Finch.

A rare summer visitor. Have seen this species on but one or two occasions each year. A pair or so breed in a large patch of wild rosebushes close to the post, and these appear to be the only ones about here. In the vicinity of Fort Lapwai, Idaho, it is one of the most common species breeding there.

62. **Pipilo megalonyx** (Bd.). Long-clawed Towhee Bunting.

The amount of white on the outer edge of the outer web of external tail feathers varies in each of the four specimens before me. None of the hind claws of these specimens are as large, however, as that given in "Birds of North America" (Baird, Brewer and Ridgway), Vol. II, p. 113. Measurements are as follows: ♂, length 8.50; wing 3.50; tail 4 inches; hind toe and claw .83 of an inch. Second, ♂, length 8.50; wing 3.50; tail 4.25; hind toe and claw .83. Third, ♂, length 8.60; wing 3.60; tail 4.25; hind toe and claw .78. Fourth, ♀, length 8.45; wing 3.25; tail 4 inches; hind toe and claw .85 of an inch. None remain about Camp Harney during the summer, and even in the higher parts of the Blue Mountains I have seen but very few during that season. A nest taken June 15, 1875, placed on the ground in a laurel bush in these mountains, contained two eggs, in which the spots are much larger and of different colors from the eggs of other races of this species. These eggs measure .96 × .69 and .85 × .70 of an inch. Ground color bluish white, marked with light rusty brown and lavender spots and blotches nearly uniformly over the entire egg. It passes north very early in the spring, having been taken March 1, 1875, during a snow storm. While here they frequent the willows and wild rose thickets along the creek bottoms.

63. **Pipilo chlorurus** (Baird). Blanding's Finch.

This handsome species is moderately abundant during the summer months. I took three nests June, 1875; these were all placed in low bushes on side hills, generally close to the tops of the hills, and from a foot to eighteen inches from the ground. There are great variations in their eggs, both in regard to their markings and in the size of the eggs, even when belonging to the same nest. I give the measurements of two sets to illustrate the latter: First set, .98 × .68; .86 × .63, .85 × .63, and .84 × .60 of an inch. Second set, .98 × .64, .92 × .59, .88 × .60 and .84 × .60. This bird was very common in Southern Arizona in the winters of 1872 and '73.

64. **Eremophila alpestris** (Boie). Shore Lark.

Taken during the winter, and also seen occasionally during the summer on the alkali plains south of the post. The latter may belong to the var. *chrysolœma*, a more southern race.

65. **Agelaius phœniceus** (Viel.). Redwing Blackbird.

A very abundant summer visitor; some remain about the swamps at Malheur Lake through the winter.

66. **Agelaius gubernator** (Bon.). Crimson-shouldered Blackbird.

This is an abundant species, but less abundant than *phœniceus*. The eggs of these two species present but little difference. As a general thing, the eggs of this form are not marked so much, and a few are unspotted. The *tricolor* I have not met with here.

67. **Xanthocephalus icterocephalus** (Baird). Yellow-headed Blackbird.

A very common species, breeding abundantly amongst the tules in Malheur Lake. None remain during the winter months. It does not breed in the swamps near the post, but confines itself strictly to the lake shore, and I have seen none at any distance therefrom.

68. **Sturnella neglecta** (Aud.). Western Lark.

A very abundant summer visitor, breeding everywhere in the lowlands, as well as in the highest mountain meadows. About Camp Harney, they raise two or three broods in a season.

69. **Icterus bullocki** (Bonap.). Bullock's Oriole.

Common during the summer months. Arrives about May 10, and leaves early in September. The eggs show great variations in size, shape and colors. One set in my collection, perfectly wedge-shaped, measures 1.02 × .60. At Fort Lapwai, Idaho, it is particularly abundant, and I have seen as many as five occupied nests on a single small birch tree.

70. **Scolecophagus cyanocephalus** (Cab.). Brewer's Blackbird.

An exceedingly abundant summer resident, a few remaining during mild winters. It breeds in various situations. On the ground the nests are placed on the very edge of the creek banks, in sagebushes when close to water, and in serviceberry bushes on a hillside near a spring. They breed in colonies, in close proximity to each other. The eggs are usually five, but occasionally seven, in a nest. The variation amongst them is very great, from a uniform coffee brown color to a light greenish gray, with spots and lines resembling the eggs of the Quiscalidæ. Scarcely any two sets are alike, and wherever a number of these birds are found breeding an endless variety of eggs can be selected.

71. **Corvus corax** var. **carnivorus** (Bartram). American Raven.

A common resident, and more or less gregarious during the winter. I have often seen as many as thirty at one time, searching the manure piles, or near the slaughter house, for food. Rarely molested they become very bold, and come to the kitchen doors to steal the food thrown to the chickens. In summer they are scattered, and seldom come about the houses. They appear to live principally on crickets and, on the edges of swamps, feed on snails and small animals. They appear to be paired throughout the year, and are generally seen in twos, seldom singly, even in midwinter. They nest early in April; the number of eggs is from five to seven. Every pair has its own district. I have found no nests nearer together than the distance of a mile. These are almost invariably placed on cliffs protected above generally by an overhanging piece of rock, and are difficult to approach. A single nest was placed on a tree on an island in Sylvies River, and not easily reached. The largest egg out of thirty-three specimens now in my collection, measures 2.38 × 1.48 inches, the smallest 1.60 × 1.22. They occasionally reoccupy a nest the following season which has been robbed. As a general thing, they are very suspicious, and will leave a nest that may be completely finished if it has been visited. Some of their nests are very bulky, and always well lined with a thick quilting of cattle hair, and are usually alive with fleas. In the winter, just after a fresh fall of snow, I have often seen pairs gamboling in the snow, going through the same performances as they would if taking a bath in the creek.

72. **Corvus caurinus** (Baird). Northwestern Fish Crow.

A rare summer resident, arriving early in March, breeding sparingly, and never in close proximity, as they do in Idaho. There, almost every birch tree of any size on certain creeks had one of their nests, and it was easy to take a hundred of their eggs in a very short time. This species is said to build a domed nest, like the Magpie, but of many hundred, I have seen none constructed in this manner;

they are all open, like those of the common crow. They rarely build in high trees, usually in birches or junipers, and often also in willow thickets, at from twelve to twenty feet from the ground. They are but very little smaller than the common crow, and many are fully as large. The only specimen accessible to me at present measures as follows: length 17.75, wing 12.60, tail 7.50, a ♀. If it were not for their totally different habits, I could see no really good reasons for separating this species. Their eggs are not distinguishable from those of the common crow. They commence breeding here about May 1, at Fort Lapwai about April 15. The usual number of eggs in a nest is five, very rarely six.

73. Picicorvus columbianus (Bonap.). Clarke's Crow.

Moderately common during the winter and spring months; none found about Camp Harney during the rest of the year. They probably retire with their young to the higher mountain ranges as soon as the latter are well able to fly. This species breeds here very early in the season. In the spring of 1876 I found several of their nests; of two found April 22, 1876, one contained three young but a few days old, the other, one young bird and two eggs on the point of hatching, one with the shell already cracked. Both nests were in pine trees. One which I brought away was placed on the extremity of a branch about twenty-five feet from the ground, and well protected from view by longer branches. It is quite bulky, but appears small as viewed from below. The nest rested on a platform of small sticks of white sage placed on the pine branches, and is composed of dry grasses, vegetable fibres, and the fine inner bark of *Juniperus occidentalis.* The whole is well woven together, and makes quite a warm comfortable structure. The outer diameter of the nest is eight and a half inches, the inner four and a half; depth inside three and a quarter inches, outside five inches. The two eggs measure, respectively, 1.22 × .95 inches and 1.20 × .90 inches. Ground color light grayish green, speckled and blotched with grayish, principally about the larger end. On the smaller egg the spots are finer and more evenly distributed. At other times a very noisy bird, when breeding it keeps exceedingly quiet, and will almost allow itself to be captured on the nest rather than to leave it; they are devoted parents. They seem to prefer the edges of the pine timber to the interior of the forests. The stomachs of several that I opened contained nothing but shelled pine seeds, forming an oily white mass. As the winter of 1875 and '76 was a very severe one, I think, that in ordinary seasons, these birds commence breeding as early as March 15. On the 5th of May, 1875, I found young birds well able to fly, which probably left their nest a week previously.[1]

74. Gymnokitta cyanocephala (Pr. Max.). Maximilian's Jay.

I saw a flock of this species, containing, perhaps, about eighty individuals, flying along Rattlesnake Creek late in October, 1875. They came from the direction of the Blue Mountains and were flying southward. They were very noisy, and flew swiftly, keeping up a constant screaming while on the wing. Two eggs of this species taken in Colorado by Mr. Chs. E. Aiken, and now in my collection, measure 1.11 × .86 and 1.10 × .88 of an inch. They were obtained May 13, 1874. Mr. Aiken describes the specimens retained by him as follows: "Of a plump oval form, color very pale greenish blue, plentifully sprinkled everywhere with specks of brown and pale lilac, which become blended at the larger end. The ground color is a grayish green, of a slightly deeper shade than in the eggs of *Picicorvus columbianus*. This nest was placed in a scrub pine and is the only one found so far containing eggs. Mr. Aiken found four other nests with young ones near the same place on the same day.

75. Pica caudata var. **hudsonica** (Bonap.). Magpie.

Not common in the vicinity of Camp Harney during the summer, more abundant throughout the winter, and much shyer than in other places. At Fort Lapwai, Idaho, they were exceedingly numerous at all times, and very familiar and mischievous. While at this post, a fine setter dog of mine would frequently carry a bone to the front of my quarters to gnaw at his leisure. After a while, four or five magpies would come about him, and watch their chance to get a peck at the bone. In order to accomplish this, one of the birds would station itself about a foot from the dog's tail, the other three or four taking their positions in front, on the sides of the dog's head. The bird in rear would watch for a chance when "Rock" was occupied with his bone, and make a sudden dive at the extremity of his tail. The enraged dog would jump around, forgetting his bone and trying to catch his tormentor. The bird would then leisurely escape. The remaining birds, in the mean time, devoted themselves to the bone, and would carry it away if small enough. If too large they would

[1] Letters from Capt. B. state that owing to the entire failure of the pine seeds, this species was not present near Camp Harney in the spring of 1877 until early in June.

pick at it till the dog returned and drove them away. I have seen the same birds pursue these tactics repeatedly, and at every fresh attack *a different bird* took his position in the rear. I was able to make sure of this, as the tails of these birds are seldom, if ever, alike. They made these attacks systematically, and acted in perfect accord with each other, as if by a previous understanding. They are very interesting, but very troublesome pets. The company I belonged to in 1870, had a tame one, that would take part in their drills, and on Sunday morning inspections took his place regularly on the right of the 1st Sergt., following him to the front when the ranks were opened. This bird almost talked, and the men were very fond of it. A cat finally killed it. They sometimes mimic other animals. I observed one here in the winter of 1876, that would crow exactly like a rooster and imitate the cackling of a hen perfectly.

76. Cyanura stelleri (Swainson). Steller's Jay.

A rare resident in the pine forests in the vicinity of Camp Harney. Two eggs of this species in my collection measure 1.20 × .90 and 1.20 × .86 of an inch. Their ground color is dark olive green, and they are marked principally about the larger end with blotches and spots of a pale rusty brown and lavender. Near the end the spots are confluent and hide the ground color. Their shape is an oblong oval, slightly more pointed at one end than on the other. An egg of the variety *frontalis* from California, measures 1.19 × .90 of an inch. In shape this egg resembles the former, but the ground color is bright green, spotted with brownish gray of two shades, the markings much finer and more evenly distributed over the entire egg, nowhere hiding the ground color, although the markings are deeper about the larger end.

77. Perisoreus canadensis ? Canada Jay.

This bird is a rather rare resident in this portion of these mountains, and is referable more to the var. *capitalis* than *obscurus*. In this section it is called "meat bird." I shot a pair on the southern base of Canyon City mountain, Nov. 1, 1875. I noticed five or six at the same time; they were gentle and unsuspicious, coming within a few feet of my camp fires, picking up bits of meat and bread which I threw to them. They are not noisy, in fact all the notes I have heard them utter on two or three occasions were rather pleasing and musical than otherwise. So far I have seen this bird in but two localities on the mountains, at different seasons of the year and they are, I believe, constant residents.

78. Tyrannus carolinensis (Baird). Kingbird.

A very common summer visitor in certain portions of this section of country, but I have not seen a single specimen in the vicinity of Camp Harney. In the John Day River Valley, and sixty miles to the east, at the Malheur Indian agency, it is not only very common, but apparently even more numerous than *T. verticalis*.

79. Tyrannus verticalis (Say). Arkansas Flycatcher.

A common summer resident, generally distributed throughout this country. They arrive here about May 1. At Fort Lapwai, Idaho, this species was also very familiar and tame, several pairs breeding about the buildings of the post. One pair placed its nest on the sill of one of the attic windows of my quarters. I protected the nest by nailing a piece of board along the outside of the window sill. While setting on her eggs the female would allow me to almost touch her before flying off. As a usual thing, they never placed their nests at any great distance from water; here at Camp Harney their habits are entirely different. None came about the post, and the majority nested at a distance from the creeks, generally in juniper trees. A large, lone pine tree near the edge of Harney Valley has been yearly occupied by several pairs of this bird, a pair of Bullock's orioles, and one of Swainson's hawks, all in apparent harmony.

80. Myiarchus cinerascens (Lawr.). Ash-throated Flycatcher.

A rare summer visitor; frequenting the juniper groves and breeding in deserted woodpeckers' holes. I found a single nest of this species June 20, 1876, containing five young birds about ten days old.

81. Sayornis sayus (Baird). Say's Pewee.

Rare, and only found during the spring migrations, usually about April 1. None breed about here. At Fort Lapwai, Idaho, I found several of their nests about the buildings in the post, in fissures of rocks and in old cliff swallow's nests. I have taken their eggs as early as April 17, 1871, containing then small embryos. The eggs are dull yellowish white, averaging .76 $\times$ .60, pointed at one end and unspotted.

82. Contopus borealis (Baird). Olive-sided Flycatcher.

A very rare summer visitor. A single specimen obtained May 29, 1876, in the pine timber near Soda Springs, summit of the Blue Mountains. Probably breeds about here.

83. Contopus virens var. **richardsonii** (Baird). Western Wood-pewee.

A moderately common summer visitor, generally found about the larger aspen groves near the summit of the neighboring mountains.

84. Empidonax pusillus (Cabanis). Little Flycatcher.

I saw a number of this species May 8, 1876, amongst the willows on Rattlesnake Creek.

85. Empidonax hammondi (Baird). Hammond's Flycatcher.

A single specimen taken (perhaps *E. obscurus*) May 15, 1876. A nest with three eggs taken June 29, 1875, belongs to probably one of these two species. It was placed in a sagebush about two and one-half feet from the ground, composed of dry grass, cottonwood down, and lined with finer grass and feathers. Measurement of eggs .64 × .51 of an inch. Color creamy white and unspotted.

86. Ceryle alcyon (Boie). Belted Kingfisher.

A rare summer visitor, a single pair only being known to breed on Rattlesnake Creek, about a mile above the post.

87. Chordeiles popetue var. **henryi** (Cassin). Western Nighthawk.

An exceedingly common summer resident, arriving about May 20; and leaving early in October. In the evenings and on cloudy days, I have seen hundreds flying about the meadows below the post in search of insects.

88. Antrostomus nuttalli (Cassin). Nuttall's Poor-will.

A rare summer visitor. A pair or two breed in close proximity to the post. I have heard its notes near the head of Bear Creek, near the summit of the Blue Mountains. August 2, 1872, I took a set of eggs of this bird near Tucson, A. T., on the barren plains south of the camp; the eggs lying on the bare ground close to the roots of a mesquite tree. These were quite fresh, elliptical in shape, of a rich cream color, and unspotted, and measured 1.06 × .81.

89. Selasphorus rufus (Swainson). Rufous-backed Humming-bird.

Rare, and only very few seen.

90. Coccygus americanus (Bonap.). Yellow-billed Cuckoo.

August 2, 1876, camping under a clump of willow bushes near Keeney's Ferry, on the Oregon side of Snake River, I found a nest of this species containing half grown young birds. The parents, at first rather uneasy, soon lost their fears and attended to the wants of their young. They were constantly going back and forth bringing crickets, and judging from the number disposed of in the three hours I noticed them, the amount required in a day must be enormous.

91. Picus villosus var. **Harrisi** (Audubon). Harris's Woodpecker.

Sparingly distributed through the forests of the Blue Mountains during the summer months; in spring and fall they frequent the shrubbery along the creeks in the valleys, and a few winter in such localities. A set of three eggs taken May 29, 1876, in the Blue Mountains, measure 1.01 × .71, .97 × .70, 1 × .71. They are of a clear white color, oblong oval in shape, slightly pointed. The nest was in a dead pine about twenty feet from the ground.

92. Picus pubescens var. **gairdneri** (Aud.). Gairdner's Woodpecker.

I only met with this species in the John Day River Valley, Oregon, and it appears to be rare there. Two sets of eggs from California measure as follows: First set, .72 × .59, .71 × .59, .70 × .58 and .70 × .60 of an inch. Second set, .75 × .51, .71 × .51, .70 × .52, .70 × .51, .69 × .53. They are clear white.

93. Picus albolarvatus (Bd.). White-headed Woodpecker.

Not common, only met with in the pine forests of the Blue Mountains. I found a nest of this species May 27, 1875, in a dead pine, and about twenty-five feet from the ground, containing two fresh eggs, measuring 1.02 × .75 and 1.02 × .73. The eggs from another set average .90 × .76. They are clear white in color, but not glossy. When passing from tree to tree this bird utters a clear ringing note, like *witt witt*. It remains here throughout the winter; its mode of flight is straighter and less undulating than that of most woodpeckers. The white about the head is always soiled, becoming a light smoky gray.

94. Picoides arcticus (Gray). Black-backed Three-toed Woodpecker.

I have seen what I take to be this species on two occasions near Soda Springs, on the Blue Mountains.

95. Sphyropicus nuchalis (Bd.). Red-naped Woodpecker.

Moderately common, confined to the aspen groves in the Blue Mountains, where it breeds. It nests earlier than most woodpeckers about here. The only nest I have examined contained good sized young, June 12, 1875. Their nests are in aspens, and generally inaccessible. I noticed three in the season of 1876 in such situations, too late for their eggs. April 22, 1876, a bird of this species amongst the sagebushes, near Malheur Lake, twenty miles from the timber, was shot by Lt. G. R. Bacon, U. S. A. Not a winter resident.

96. Hylotomus pileatus (Baird). Black Woodcock.

A constant but rare resident. Have seen specimens of this bird but twice.

97. Melanerpes torquatus (Bonap.). Lewis Woodpecker.

A very common summer resident in the vicinity of Camp Harney, breeding abundantly in the juniper groves as well as in the edges of the forests. It prefers the more open districts, and arrives here about May 1; remains until the middle of October. The usual number of eggs laid is seven. These measure from 1.12 × .80 and 1.10 × .81 for the largest, to 1.02 × .79 and 1 × .78 for the smallest, selected from a large series. In one nest I found an egg measuring .78 × .58. Comparing these eggs with a series of the *C. mexicanus*, I find them longer in shape and not so globular. The color is also different, in *M. torquatus* the white is opaque, and never so glossy and shining. In cleanly prepared specimens of both species the difference is very perceptible. The young of this species, when disturbed in their nest, make a very curious hissing noise, like the buzzing of a swarm of bees. They commence breeding about May 20.

98. Colaptes mexicanus (Swainson). Red-shafted Flicker.

Even more common than the preceding, arriving the latter part of March, and a few remain in the lower Harney Valley throughout the winter. They commence breeding about May 15, and raise two broods in a season. The usual number of eggs is from six to eight. The largest of these measure 1.20 × .91 and 1.19 × .90; the smallest 1.04 × .86 and 1.01 × .83 of an inch. A nest of this species found June 6, 1875, in a rotten pine stump, contained besides three young birds just hatched and two eggs on the point of hatching, also four perfectly fresh eggs of the usual size, and one measuring only .80 × .60 of an inch. Their principal food seems to consist of crickets, while these are in season. I have found this species occupying the same stump with a pair of sparrow hawks, both breeding at the same time, the entrance to their holes being on opposite sides, and also again with a pair of long-eared owls, their holes only two and and one-half feet apart, and on the same side, the owl using the lower story.

99. Colaptes hybridus (Baird). Hybrid Flicker.

In the spring of 1875 a well marked specimen of this race was shot by Lieut. D. Cornman, U. S. A., among a number of *C. mexicanus.*

100. Otus vulgaris var. **wilsonianus** (Less.). Long-eared Owl.

Moderately abundant and resident, frequenting the dense willow thickets along the streams, and here constructing their own nests. At Fort Lapwai, Idaho, they occupy the old nests of the *Corvus caurinus* when not too much exposed to light, and also breed in hollow cottonwood trees, the entrance to the nest being often very small, with barely room for the bird to enter. The average number of eggs in sixteen nests is five, occasionally six. Most of the nests were lined with feathers. When occupying old nests they build up the sides, so that these are always deeper than ordinary crows' nests, hiding the bird from view below. They commence laying about April 15.

101. Otus brachyotus (Steph.). Short-eared Owl.

Not nearly so common as the preceding species, and only a summer resident, confining itself to the marshes near Malheur Lake. One of my men brought me two sets of eggs of this owl found May 28, 1876, in a large swamp eight miles east of the post, and one of the birds. The nests were on the ground on the side of, and partly covered by, bunches of rye grass, and on slightly elevated ground in the marsh, with three fresh eggs each, the birds not having finished laying. This species breeds also about Fort Lapwai, Idaho, where I took two of their nests on May 1 and 6, 1871. Both were found in swampy places, and constructed of dry grasses and a few feathers. The eggs of this species are not of a clear white, though this may be their color when first laid, but have a yellowish tinge. A set of three measure 1.60×1.20, 1.57×1.20 and 1.52×1.21 of an inch.

102. Nyctale acadica (Bonap.). Saw-whet Owl.

Only taken during very cold weather in the winter. Several have been brought to me alive in a starved condition, and I only succeeded in keeping one for any length of time. This I fed at first on live mice, the only thing it would touch, but after awhile it ate the carcasses of birds, and would eat twice its own weight in a day. If several whole birds were thrown into its cage it would eat the heads of all of them first, and hide the bodies in the corners of the cage, covering them up with loose feathers. Once I put a red winged blackbird, perfectly unharmed, in the cage with it, which it at once killed. Flying to its perch it grasped it with two of its toes in front and two in rear, and always sat in this manner. I kept it supplied with fresh water, but I think it never used any. Although I have not found it here during the summer months, I think it a resident, and that it breeds here.

103. Bubo virginianus var. **arcticus** (Swainson). Western Great Horned Owl.

Several specimens taken at different seasons are referable to this variety, while differing in coloration. It appears to be common, particularly so amongst the dense willow thickets on Sylvies River, where it also breeds and finds abundance of food in the numerous heronries.

104. Nyctia arctica (Gray). Snowy Owl.

A rare winter visitor, observed on several occasions, but no specimens procured.

105. Glaucidium californicum (Sclater). California Pigmy Owl.

Moderately abundant during the winter, and some unquestionably breed. It attacks animals nearly as large as itself, and manages to carry them to some distance. A correspondent residing in southern California, found the nest of this owl June 8, 1876, captured the bird on the nest, and writes me as follows: "While out collecting I saw a small owl fly into a large dead poplar tree and alight on a limb, and as he had a bird in his claws I watched him. Soon I saw his mate fly from a hole in the top of the tree, take the bird (*Pipilo fuscus*) and fly back in the hole. On climbing the tree I found a pigmy owl setting on two eggs which were almost hatched. I took the eggs, and on stirring up the nest which was made of twigs, I felt another egg which I broke in getting out. The eggs are not round, but much like the eggs of the common dove (*Zonaidura carolinus*) in size and shape." The measurement of one of these eggs is $1.19 \times .92$; the other is a trifle larger.[1] February 5, 1875, I shot a specimen of this species, a ♀, at quite a distance from timber. It was sitting on a large boulder at the base of a perpendicular cliff, but they are seldom seen at any distance from the pine forests.

106. Spheotyto cunicularia var. **hypogæa** (Bonap.). Burrowing Owl.

A common summer resident, arriving about the end of March. I found it abundant at Fort Lapwai, Idaho, where I obtained a number of their eggs. They preferred hillsides having a southerly exposure.

[1] See Proceedings Bost. Soc. Nat. Hist., XVIII, p. 162.

Their holes varied in depth and direction; some were almost straight, others in the shape of a horse shoe, the chamber containing the nest being on a level with the entrance, and in one instance not over a foot from it, although the whole length of the burrow was at least seven feet. Their nests, of which I examined at least sixteen, consisted of dry cow- or horse-dung, in small pieces, and spread about one and one-half inches thick on the floor of the chamber, which itself was somewhat larger than the passage to it. The usual number of eggs from eight to nine, in one instance ten. The nests were alive with fleas, and the eggs so discolored by them that they resembled more the eggs of the falcons or willow grouse than their natural color. The birds will remain on their nest and allow themselves to be captured rather than leave the eggs or young. They raise but a brood a season. Their food consists almost exclusively of noxious insects, particularly crickets, and they are exceedingly beneficial to farmers. I do not recollect of having found the remnants of a single small bird in their burrows, but have seen small frogs and mice; their principal food, however, appears to be grasshoppers and crickets. They commence laying about April 25, and work on their burrows at least two weeks before. Only once have I seen one of the birds at work. It pushes and scratches the dirt backwards with its feet. That they live in harmony with rodents and rattlesnakes is not my opinion. A snake may occasionally enter one of their burrows, but it certainly is never a welcome visitor. I have never found any other living animal in their burrows, and I have examined many. During the breeding season the male utters a call-note resembling that of the European cuckoo (*C. canorus* L.), and scarcely distinguishable from it. Their eggs are not as round, but glossier than owls' eggs generally; some are considerably pointed, a rather unusual shape for eggs of the owl family, and they measure from 1.35 × 1.09 to 1.20 × .98 of an inch. Their color after washing them is pure white.[1]

107. **Falco polyagrus** (Cassin). Prairie Falcon.

Not at all rare during the migrations of the water fowl. A few breed in this vicinity, but I have been unable to find their nests. It

[1]Another owl which is unquestionably found here, but which I have not seen, is *Syrnium cinereum* Aud. It breeds in the Blue Mountains, near Fort Lapwai, Idaho; as I obtained a young bird there just able to fly, in the early spring of 1870, from an Indian. I kept it over a year. It became quite tame and useful, being a perfect terror to rats and mice, and keeping the granary at the post free from these pests.

will make repeated attempts to capture full-grown chickens in the post, paying no attention to the close proximity of several men, but returning again after a few minutes to make another attempt. In the fall they become excessively fat. A very old female shot by Lt. G. A. Bacon, U. S. A., Nov. 23, 1875, and now in the collection of the Smithsonian Institution, Washington, weighed four pounds twelve ounces. Length 18.50, wing 13.25, tail 8 inches. Iris blue, base of bill and cerci light blue, the tip darker; tarsi and toes pale greenish blue.

108. **Falco communis** var. **anatum** (Bonap.). Duck Hawk.

Rarer than the preceding species, and only seen near Malheur Lake, attracted by the great numbers of water fowls of all kinds.

109. **Falco columbarius** (Linn.) var. **richardsoni.** Pigeon Hawk.

Rather rare. A nest of this species in a large pine tree May, 1876, contained young. The old birds were carrying them food. This is the only nest I have seen.

110. **Falco sparverius** (Linn.). Sparrow Hawk.

A very common summer resident, breeding abundantly about Camp Harney, usually occupying old woodpeckers' nests in juniper trees. In about twenty-five nests of this species the largest and usual number of eggs has been five. These vary in color, size and shape. In some the ground color is a pure white, in others cream color, and again a very dark buff. One egg is almost pure white, with scarcely perceptible spots, others are spotted and blotched with a reddish brown over the entire egg. A very handsome specimen has the ground color pure white with large blotches and spots of brownish red and lavender, aggregated principally about the smaller end. The largest egg in sixty is 1.45×1.17, the smallest 1.20×1.10 of an inch. It is one of the latest to breed, commencing to lay about May 20. It rears but a single brood a season.

111. **Pandion carolinensis** (Gmel.). Fish Hawk.

A rare summer visitor; a pair breeds yearly on the lower Sylvies River. I also took a nest near Fort Lapwai, Idaho, in 1876.

112. **Circus cyaneus** var. **hudsonius** (Linn.). Marsh Hawk.

Moderately abundant and a few resident. A set of eggs taken near Fort Lapwai, Idaho, June 15, 1871, is very distinctly spotted with dirty brown. In two specimens the spots are few but very large, and in all they are plainly visible. Several other sets show no indications of spots. The usual number of eggs seems to be five, but I have found six in a nest on two occasions. They vary considerably in shape and size.

113. Nisus fuscus (Gmel.). Sharp-shinned Hawk.

Rather rare at all seasons.

114. Nisus cooperi (Bonap.). Cooper's Hawk.

Also rare, and seldom seen. I have found this species breeding about Fort Lapwai, Idaho, and near Tucson, A. T.

115. Astur palumbarius var. **atricapillus** (Wilson). Goshawk.

Not common, a few pairs breed in the mountains north of Camp Harney. I have taken its eggs both here and near Fort Lapwai, Idaho. An occasional set of their eggs are faintly spotted with pale reddish brown, sparingly distributed about the larger end of the egg. Number of eggs usually two.

116. Buteo swainsoni (Bonap.). Swainson's Hawk.

A common summer resident, generally distributed throughout this country, breeding in the willows along the streams, and in isolated juniper and pine trees on the edge of the forests. The usual number of eggs in twenty-five nests has been two, rarely three. The eggs vary greatly in coloration, while their size is pretty uniform, as well as their shape. Their average size is about 2.25×1.75 of an inch. The ground color is pale greenish white marked with well defined spots and blotches of a dark and light brown. Some are sparingly spotted, and the spots more distinct than in others. An occasional set is unspotted.

117. Buteo borealis var. **calurus** (Cassin). Western Red-tailed Hawk.

Moderately common resident, and one of the earliest hawks to breed. It generally constructs its nests in large pines near the edge of the forests, and a few breed in the largest willows on Silvies River near the different heronries located on this stream. In a number of nests from different localities I have found but two eggs, seldom three, and in only one instance four. These vary greatly in color and size; the average size of a number in my collection is 2.42×1.77 of an inch. Some of these are very heavily marked with different shades of brown, others are nearly unspotted.

118. Archibuteo ferrugineus (Licht.). Squirrel Hawk.

Rather rare, but more common in the open country to the southward, particularly so near Camp McDermitt, Nev., where it breeds.

119. Archibuteo lagopus var. **sanctijohannis** (Gr.). Rough-legged Hawk.

An irregular winter visitor, common at some seasons, and entirely wanting in others. During the winter of 1874 and 1875 I shot a number, while in the succeeding season I noticed only a single one. No two birds were alike in plumage, the lighter colored specimens predominating. I only secured a single very dark colored male March 6, 1875. In April they had all disappeared. Their principal food while here was cotton-tail rabbits.

120. Aquila chrysaëtus var. **Canadensis** (Linn.). Golden Eagle.

Moderately abundant throughout the mountainous portions during the greater part of the year. Each pair appears to confine itself to a certain district, and no others breed there. I have heard of several nests in this vicinity at intervals of about twenty miles from the other. One pair had occupied a nest within three miles of this post for a number of years. It was an enormous structure, some of the sticks of which it was composed were over two inches in diameter. It was placed on a large pine tree close to the trunk, about three and a half feet high and nearly three feet wide. It contained two young birds about two weeks old May 18, 1875. These I took some three weeks afterwards, and have them at present, Jan., 1877. The top of the nest was nearly flat and contained, besides the birds, a medium sized specimen of *Arctomys flaviventer* (Bachman) weighing about three pounds, partly eaten up. The old birds made no resistance when their young were taken, one only circling around some five hundred yards above the tree, uttering a shrill cry resembling *kiah kiah*. The young were very cleanly, and fed readily on fresh meat, and also used water freely. One is considerably larger than the other (presumably a female). I had some hopes of taming this bird at first, but have given this up long since as a useless attempt. The small one was always cross, and at present it is unsafe for any one to go into the stable without a good sized club. They will attack anything coming near them, and are particularly hostile to dogs. Both birds are larger than an old male of this species caught in a trap and brought to me some time in the winter of 1875. Its colors were much lighter than those of the young, which are dark brownish black throughout, excepting the basal portion of the tail, which is greyish white, and the nape on which the feathers are edged with fulvous. The birds are very fond of bathing and keep themselves scrupulously clean.

Their strength is wonderful, and I have had several excellent opportunities to test this to my perfect satisfaction. The old birds did not reoccupy the nest, but built a new one about a mile from the old site on a large pine and inaccessible. They are generally seen hunting in pairs in the early spring, chasing ducks, geese and sagehens, and mostly successfully. I came within a few feet of one gorging itself on a yellow-footed marmot it had just captured; several magpies were watching their chances to steal morsels of the animal from him, and this occupied his attention so much that he did not notice my approach. They are very shy and wary, taking good care to keep out of gunshot. My birds when young often drank water, and I have no doubt but what they use it now. Their appetite is enormous, and as they have been always well fed, this may account for their large size. Their usual notes are *kée kée kée* and *kiah kiah*, frequently repeated. The latter they seem to use when anything disturbs them. In this vicinity they commence breeding about April 1. In the John Day River valley they are said to carry off young lambs.

121. Haliaëtus leucocephalus (Linn.). Bald Eagle.

Not nearly so common as the preceding. I obtained a single specimen Feb. 18, 1875, which was nearly starved to death. A pair breeds on Silvies River, and are the only ones I have seen here.

122. Rhinogryphus aura (Linn.). Turkey Buzzard.

Moderately common during the summer months and breeding in this vicinity. They arrive here early in April, and I saw one the 27th of Nov., 1875, after a fall of snow.

123. Zenaidura carolinensis (Bonap.). Common Dove.

An abundant summer resident, arriving about May 1, breeding both on trees and on the ground. In this latitude they rear but a single brood a season, while in Arizona I found fresh eggs of this species as late as Sept. 14.

124. Canace obscurus (Say). Dusky or Blue Grouse.

A common resident throughout the mountains. We have two varieties, *fuliginosus* and *richardsoni*, the former being the most abundant. They seem to prefer the more open forests to the dense timbered sections, and while the young are small they frequent the creek bottoms and open side hills almost exclusively. At such times I have found them twenty miles from timber of any size. After pairing, the males separate from the hens, and are frequently found in small coveys,

[1] I have been told that the *Columba fasciata* (Say) is not rare in the John Day River Valley, Oregon, but I have not seen any.

from four to six, sunning themselves on high rocky points, crouching close to the rocks if anything approaches to disturb them. In the early part of the fall they rarely fly into trees when flushed, but later in the season they do so almost invariably. It is said that where a number are found in one tree, by shooting always the lowest first the rest will remain, and that they can all be killed; but I never got more than two shots at birds in one tree. They sit close, and usually lengthways on a limb, like Night Hawks, as long as they think they have not been discovered, but after the first shot they generally all take wing. In the winter they seldom alight on the ground, excepting to get water. They feed on the tender buds of the spruce or pine, and their flesh is not palatable. In the fall they are in splendid condition, and without a doubt the best game bird in this country. They feed then almost exclusively on wild berries, of which they find an abundance, preferring a species of wild gooseberry, but eat service, thimble and salmon-berries, wild currants and cherries, with an occasional cricket or grasshopper, and now and then a few tender tops of plants. The full complement of eggs is from eight to ten. These vary considerably in size, shape and color. In some the ground color might be called a creamy white, in others it is a pale, and again a very deep buff. The eggs are evenly spotted with specks of reddish brown, and none of these larger than an ordinary sized pin head. Their shape is an elongated oval, and they measure as follows, each egg out of different nests: 1.99×1.30, 2.02×1.33, 1.84×1.35, 1.90×1.30, 1.86×1.40 and 1.80×1.23. Considering the size of the bird their eggs are very small. They commence laying about May 1. Their nests are always on the ground, generally close to, or under a fallen tree, occasionally in a cavity of a burnt and fallen log, and also in the open air without any cover whatever. I found such a nest on June 7, 1876, near the summit of the Canyon City mountain. It was placed in perfectly open ground about two feet from the roots of a young fir tree, and contained nine eggs on the point of hatching, all being chipped already. The eggs were laid on the bare ground, a few feathers of the bird and a little dry grass being placed around the edges of the nest. I have several times flushed quite young birds and noticed how quickly they hide themselves, even where there is little to conceal them. The young can soon fly, even when not larger than a man's fist. The love notes of the male, called here hooting, in the early spring, are very peculiar and hard to describe.

125. Centrocercus urophasianus (Sw.). Sage Cock.

A common resident species, particularly abundant in the upper Sylvies Valley at an altitude of about six thousand feet. During the winter, however, they do not remain there, but frequent Harney Valley some twelve hundred feet lower, where comparatively few breed. Their food consists principally of the leaves of the sagebush (Artemisia), the seed tops of various grasses, and also crickets. The young birds are particularly fond of the latter. Their nests are a slight depression in the sandy ground, close to a sagebush, or on the side and partly covered by a bunch of rye grass, lined with a little grass and a few feathers. The eggs are from seven to ten in number, generally eight or nine. They commence laying about April 15. The eggs vary a good deal in their ground color, which usually is a pale drab or buff color, and occasionally a dirty green, something like the color of a Mallard's egg. They are marked with chocolate brown spots varying in size, and nearly evenly distributed over the entire egg. Eggs out of different nests measure as follows: 2.24×1.58, 2.30×1.46, 2.01×1.40, 2.25×1.50, 2.19×1.50, 1.98×1.49, 2.02×1.38. The young are of full size by the middle of July, and are then excellent eating provided they are drawn at once after they have been shot; this applies only to young birds. On one occasion I have seen three of these birds sitting on a horizontal limb of a juniper about two feet from the ground, which was then covered with a foot of snow. As a usual thing they roost on the ground. In winter I have often seen packs of fifty and more; at such times they are very shy and difficult of approach. They rise with a loud rumbling noise, and when once started their flight is swift and protracted.

126. Pedioecetes columbianus (Baird). Sharp-tailed Grouse.

Only a moderately common resident, apparently irregularly distributed. In the winter I have seen packs of from one to two hundred in the vicinity of Port Lapwai, Idaho. They frequently roost on the willow bushes along the streams, and I have seen them alight on pine trees on the outskirts of the timber. In the vicinity of Camp Harney they are mostly found in the juniper groves during the cold weather, and the birds live almost exclusively on the berries of these trees. The eggs usually number from eleven to fourteen.

127. Bonasa umbellus var. **umbelloides** (Douglas). The Mountain Ruffed Grouse.

A rather rare resident about here, frequenting the densest undergrowth along the mountain streams, and seldom seen. It is considerably smaller than *sabini*, measuring only from fourteen to fifteen inches in length.

128. Bonasa umbellus var. **sabini** (Douglas). Oregon Grouse.

Moderately common in the John Day River Valley, Oregon. It is very abundant in the aspen groves bordering marshy tracts of land in the trail from Fort Lapwai, Idaho, to Fort Colville, W. T., where I have seen as many as thirty birds in a day's travel, without leaving the road. A set of eggs of this species collected on Vancouver Island, B. C., is of a rich reddish buff color, resembling somewhat in shade the eggs of *Oreortyx pictus* (Baird), and faintly spotted with pale lavender. They are considerably pointed at one end, and measure 1.70 × 1.20 to 1.60 × 1.22 of an inch.

129. Ortyx virginianus (Bonap.). Bob-white.

This species may properly be included in the avifauna of southeastern Oregon. It was originally introduced at Boise City, Idaho, and extends now to the Oregon side of Snake River, and is multiplying rapidly.[1]

130. Ægialitis vociferus (Linn.). Killdeer Plover.

Generally distributed throughout the country wherever water is to be found, one of the earliest birds to arrive in the spring; breeds.

131. Recurvirostra americana (Gmel.). Avocet.

An abundant summer resident in the lower valleys, but not in the higher regions in the Blue Mountains anywhere above forty-eight hundred feet altitude. Breeds near Malheur Lake and the swampy shores of Sylvies River.

132. Himantopus nigricollis (Vieill.). Black-necked Stilt.

Found associated with the former species, frequenting the same localities, but it is not so common; breeds.

[1] I expected to find the *Canace canadensis* var. *franklini* (Douglas) common in this portion of the Blue Mountains; it does not occur in this section as far west as Camp Harney, or Canyon City, Oregon. It is a common species in the Blue Mountains, near Fort Lapwai, Idaho, and is universally known throughout that region as the Fool-hen. The *Oreortyx pictus* (Baird), Mountain Quail, is also wanting here.

133. **Phalaropus wilsoni** (Sab.). Wilson's Phalarope.

A moderately common summer resident, breeding, and at this time generally associated with the Willets, and resembling these birds in their actions when any one comes in the vicinity where they have their nests.

134. **Phalaropus hyperboreus** (Tem.). Northern Phalarope.

I saw a flock of this species and shot two en April 26, 1876, in a shallow slough near Malheur Lake.

135. **Gallinago wilsoni** (Bonap.). Wilson's Snipe.

Rare in the vicinity of Camp Harney; I noticed a pair June, 1876, undoubtedly nesting in the marsh in which I started them.

136. **Macrorhamphus griseus** (Leach). Gray Snipe.

Very common during the migrations, I believe that it breeds in the higher mountain valleys,

137. **Ereunetes pusillus** (Linn.). Semipalmated Sandpiper.

Common during the migrations. Several individuals remained near a pond close to the post, till the latter part of May.

138. **Totanus semipalmatus** (Gmel.). Willet.

An abundant summer resident. I have taken several sets of their eggs. They commence laying here about May 10. They are eqnally abundant in the higher mountain valleys at an altitude of six thousand feet and more, in fact they are found everywhere where there are marshes.

139. **Totanus melanoleucus** (Gmel.). Stone Snipe.

Abundant during the migrations.

140. **Totanus flavipes** (Gmel.). Yellow Legs.

The same remark applies to this species.

141. **Tringoides macularius** (Gray). Spotted Sandpiper.

A moderately abundant summer resident. I have found it breeding in the wet camas prairie south of Camp Harney, and also in the vicinity of Fort Lapwai, Idaho. It seems to be generally distributed.

142. **Numenius longirostris** (Wils.). Long-billed Curlew.

A common summer resident, breeding abundantly. It generally makes its nest in the wet and partly flooded meadows; in the spring of 1876, I found three sets partly covered with water, and abandoned. This was on May 13; I have found full sets (four) two weeks earlier. Near Fort Lapwai, Idaho, these birds bred on the high and dry prairies several miles from the nearest water. It breeds also in Southern Arizona, near Sulphur Springs, about thirty miles west of Camp Bowie. Their eggs vary a good deal in size, shape and coloration, even when coming out of one nest. These are excellent eating, and very large for the size of the bird, average about 2.60 × 1.74. By the first of August they have all left, congregating in large flocks before migrating. Their principal food here seems to be crickets.

143. Ibis Ordi (Bonap.). Glossy Ibis.

I have not actually taken this species in Oregon, but as it has been found breeding near Quinn River Crossing, Nev., twenty miles from the State line, it is to be presumed that it ranges into this State. Lt. Wood, U. S. A., shot a specimen July 15, 1875, at the above mentioned locality, where he saw some forty of these birds with young still unable to fly.

144. Ardea herodias (Linn.). Great Blue Heron.

A very common summer resident throughout the lower Harney Valley. It breeds in large numbers on one of the small islands in Malheur Lake, in company with *Pelecanus trachyrhynchus* and *Graculus dilophus.* Its nests there are placed in greasewood bushes from two to four feet from the ground, and nearly every bush contained a nest. These are flat structures, built out of such material as is readily found close at hand, consisting here for the most part of dry greasewood sticks and a few pieces of dry tule and a little swamp grass for an inner lining. The usual number of eggs in all the nests containing their full complement was five. The largest egg in a great number measures 2.73 × 1.96, another in the same set only 2.40 × 1.82 of an inch. They average about 2·65 × 1.80. Their color varies from a very bright uniform light green to a pale greenish white, the shell in the latter variety presenting a mottled appearance. One or two eggs in each set are always paler than the others, which probably were laid first. They commence laying here about April 20. The young for the first two weeks are almost destitute of feathers, and emit a hissing noise when disturbed. They sit close together on their nests forming a circle, with the heads all turned inward. The old birds do not appear to be much concerned if one of their colonies is disturbed and make off out of sight at once. Another large colony of these birds breeds on the lower Sylvies River on willow bushes, in company with other species of herons, but on the islands no other herons are found breeding with this species.

145. Herodias egretta var. **californica** (Baird). Great White Egret.

A moderately common summer resident, breeding in the thick willows on the lower Sylvies River, in company with other species of herons.

146. Ardea candidissima (Gml.). Little White Egret.

The same remarks apply to this species, which is found in the same locality.

147. Nyctiardea nævia (Bodd.). Night Heron.

An extremely common summer resident, breeding in large numbers on the lower Sylvies River, where their nests are often placed in quite low willows, not more than three feet from the ground.[1]

148. Ardetta exilis (Gray). Least Bittern.

Apparently rare. I have seen it on but two occasions. It is, however, easily overlooked, and may be rather common.

149. Botaurus minor (Gml.). Bittern.

A moderately common summer resident, found in all the swamps throughout this section of country, even in the mountains, oftener heard, however, than seen. The usual number of eggs laid by this species is five and six, and seven even is not very uncommon.

150. Grus canadensis (Linn.). Sandhill Crane.

A common summer resident. Breeds abundantly on the lowlands as well as in the highest mountain valleys. Their hoarse cries can be heard almost everywhere where there is any water to be found, and as long as the locality is comparatively quiet, as they are a shy and wary bird. Each pair seems to occupy a certain district during the breeding season, and I have never found two pairs breeding within half a mile of each other. The eggs are usually laid about May 1, and I have never found more than two in a nest. The largest of these measure 4.25×2.34 and 4.20×2.42 of an inch.[2]

151. Porzana carolina (Linn.). Carolina Rail.

This species occurs here during the breeding season, but whether common or not I am unable to say; have only seen it on three or four occasions. I have had it brought to me alive by Indians.

152. Porzana jamaicensis (Gml.). Little Black Rail.

Seen on two occasions in the swamps near Malheur Lake, where it unquestionably breeds.

153. Fulica americana (Gml.). Mud-hen.

A very common summer resident, found in large numbers on Malheur Lake, where it breeds.

[1] I believe that *Ardea virescens* breeds in the same locality, and may be quite common, but I have not seen any specimens.

[2] The white or whooping crane is not found in this country; probably none are found west of the Rocky Mountains.

154. Cygnus americanus (Sharp.). American Swan.

Very common on the borders of Malheur Lake during the migrations. A few remain as long as April 24, and in the upper Sylvies valley, in the Blue Mountains, I heard what I took to be the trumpeting of this species on May 29, 1876. It is possible that a number of cripples remaining during the summer on the lakes gave rise to the idea that they breed here. The meat of the young birds is, in my opinion, excellent eating, far superior to that of any of the geese found about here. While here they feed on the small bulbous roots of a water plant growing near the shores of the lake. The stomach of a specimen shot Nov. 11, 1874, contained some twenty small sea shells.

155. Cygnus buccinator (Rich.).

A single specimen was taken at Malheur Lake March 24, 1877.

156. Anser albifrons var. **Gambeli** (Hartt). Speckled-bellied goose.

Very common during the migrations, and generally the first to arrive from the north.

157. Anser hyperboreus (Pall.). Snow goose.[1]

Also very common during the migrations.

158. Anser Rossii (Baird). Ross' Goose.

A single specimen obtained on Silvies River, Oregon, April 12, 1876. It appears to be a rare species, was shot out of a flock of twelve by Sergt. Kennedy of my company, and is now in the collection of the Museum of Comparative Zoology, Cambridge, Mass. The bird weighed two and three-fourths pounds, and measured as follows: ♀, length to tip of tail, 22.75; to end of middle claw, 24.25; wing 13.75; tail, 4.75. Iris light blue. Feet and tarsi purple. Bill pale horn color, nail black. Its notes are said to differ from those of the snow goose.

159. Branta canadensis (Linn.). Canada Goose.

Only partly migratory; a number remain to breed. I took several nests of this species on the islands in Malheur Lake in April, 1875, all of these were placed on the ground or on drifts of tule in the water. The largest number of eggs I found in a nest was six. In the spring of 1876, when I visited the lake again, I did not find a single nest on the ground; the few which I did see were all placed in willow trees, and not accessible on account of high water. Measurements of eggs out of different nests are as follows: 3.57×2.25, 3.49×2.26, 3.40×2.32, and 3.33×2.36.

[1] The variety *Hutchinsii* does not breed here.

160. Branta bernicla var. **nigricans** (Lawr.). Black Brant.
Migratory and rather uncommon. I have seen several in the hands of Indians.

161. Anas boschas (Linn.). Mallard.
A common resident, breeds abundantly; found throughout the year where there is open water.

162. Dafila acuta (Linn.). Pin-tail.
Common during the migrations; none remain to breed.

163. Chaulelasmus streperus (Linn.). Gadwall.
A very common summer resident, breeding abundantly about the swampy shores of Malheur Lake. I have found perfectly fresh eggs of this species as late as July 20. Its flesh is very inferior.

164. Mareca americana (Gmel.). American Widgeon.
A rather common summer resident, found breeding in several localities.

165. Nettion carolinensis (Gmel.). Green-winged Teal.
Equally common, and breeds; seems to be more partial to the smaller mountain streams than the large bodies of water in the valleys during the breeding season.

166. Querquedula discors (Linn.). Blue-winged Teal.
Not so common as the preceding species. I doubt if any breed here.

167. Querquedula cyanoptera (Vieill.). Red-breasted Teal.
More common than either of the two preceding species; breeding in large numbers. They commence laying here about May 15, and frequently their nests are placed a hundred yards or more from the nearest water.

168. Spatula clypeata (Linn.). Spoonbill.
Not very common, but possibly breeds at Keeney's ferry on Snake River, where I saw several birds of this species August 2, 1876. During the winter months these birds are found in immense numbers at Owen's Lake, in Inyo County, Cal.

169. Aix sponsa (Linn.). Wood Duck.
Very rare. A single pair were shot by Lieut. G. R. Bacon, U. S. A., in the fall of 1876.

170. Fuligula marila (Linn.). Big Blackhead.
Very common during the migrations.

171. Fuligula affinis (Eyton). Little Blackhead.
About equally common during the migrations, and I believe a few

breed in upper Sylvies valley in the Blue Mountains, where I noticed several specimens June 8, 1876.

172. Fuligula collaris (Bonap.). Ring-necked Duck.

Not so common as either the two preceding species during the migrations, and oftener found on the deeper portions of the lake than in the creeks and sloughs.

173. Aythya americana (Bonap.). Redhead.

Common during the migrations, and probably a few breed about here.

174. Aythya valisneria (Bonap.). Canvass-back.

Equally common during the migrations, and breeding in the higher mountain valleys in the Blue Mountains, where I found them nesting on Bear Creek, at an altitude of six thousand feet. In the spring and fall they frequent the shallow portions of Malheur Lake in immense flocks, but are not so well flavored as in the east.

175. Bucephala clangula (Linn.). Golden-eye.

Rather common during the migrations.[1]

176. Bucephala albeola (Baird). Butterball.

Common during the migrations.

177. Oedemia americana (Swainson). Scoter.

Not uncommon on the more open portions of Malheur Lake, but very shy and difficult of approach.[2]

178. Mergus merganser (Linn.). Sheldrake.

Common; found in nearly every mountain stream during the migrations.

179. Mergus serrator (Linn.). Red-breasted Merganser.

I believe this species breeds on Bear Creek in the Blue Mountains, where I found it common in August, 1876.

180. Mergus cucullatus (Linn.). Hooded Merganser.

This is the most common of three species of Mergansers, and I believe that it breeds here also. It is less often found in the small creeks than in the lake, where it is particularly abundant during the migrations.

181. Pelecanus trachyrhynchus (Lath.). White Pelican.

A very common summer resident, making its appearance early in

[1] *B. islandica* I have so far not seen about here, and I doubt whether it visits this section.

[2] I have no doubt that several other species of sea ducks frequent the lake in the spring and fall, but as most of the hunting is done on the shore, and the creeks and sloughs emptying into it, they have been overlooked so far.

the spring before the lakes are fairly free of ice, and leaving for southern parts in the commencement of November. It breeds in large numbers on several of the small islands in the eastern part of Malheur Lake, commencing to deposit its eggs as early as April 12. The nest is a mere depression scraped in the sand, and usually contains two eggs, occasionally three. I have, however, found as many as five in a single nest. They breed in communities, the nests being about a yard apart.[1] The peculiar projection on the bill of the birds commonly called the centre-board, is not restricted to the male alone; the female has it as well, and it is perhaps only wanting in immature birds.[2] The birds found on Malheur Lake agree pretty well with Latham's description, excepting the pinkish tinge. Not a single specimen examined by me showed even a trace of pink. The occipital crest varies in my specimens from three and a half to four and a quarter inches in length, the feathers being almost white, only in a few instances there is a very faint tinge of pale straw yellow perceptible in it. The lower mandibles in all the specimens examined show the black spot in the central portion mentioned by Latham. These spots are irrregular in outline, and average about a quarter of an inch in diameter. They consequently differ from the bird described by Mr. Ridgway taken at Pyramid Lake, Nevada, on May 28, 1868, in this, — that they have a decided occipital crest, which is wanting in his specimens examined, and not a single one showed the occipital region covered by a patch of dark brownish grey, which seems to have been characteristic in all the specimens examined by him, and that they all show a black spot on the lower mandible which is wanting in his. Otherwise his description agrees with the bird found here. Through the kindness of Lieut. George R. Bacon, U. S. Army, I am enabled to give the measurements of four specimens shot by him April 23, 1876, and taken at the time. No. 1, adult male, length 63.75; to tip of claws, 68; extent of wings, 103.50; wing, 24.25; tail 8; culmen, 15 inches. Iris ashy white, tarsi and feet rich bright orange red, nail of bill yellow. No. 2, ♂, length, 62.25; tip of claws, 65.75; extent of wings, 102.25; wing, 24; tail,

[1] See the Proceedings of the Boston Society of Natural History. Vol. XVIII, Oct. 6, 1875, pp. 165–167.

[2] Judging from the minute description given by Mr. Robert Ridgway, in an article published in the "American Sportsman," August 8, 1874, relating to these birds, it would appear that we have two distinct varieties of white pelicans in the west, if not two good species.

8.50; culmen, 14.25 inches. Iris ashy white, tarsi rich orange. No. 3, ♀, length, 54.40; tip of claws, 58.75; extent of wings, 90.75; wing, 22; tail, 7.50; culmen, 11.50. Tarsi and toes bright orange red. No. 4, ♀, length, 53.50; tip of claws, 57.50; wing, 20.80; tail, 7.25; culmen, 11.05 in inches. Not a trace of pink observable in any of the specimens. Both females appeared to be adult birds, possessed the centreboard, and were breeding. An egg nearly ready for exclusion was taken from the oviduct of specimen No. 4. Eggs of these birds placed under a hen hatched in twenty-nine days. The eggs of this species are of a dull chalky white color, and average about 3.45 × 2.30 of an inch. By measurements furnished me by Mr. J. I. Howland, of Newport, Rhode Island, of a number of eggs of these birds breeding at Pyramid Lake, Nev., taken May 15, 1875, it would appear that the eggs found there average a trifle smaller than those taken by me at Malheur Lake.

182. Graculus dilophus (Gray). Shag.

A common summer resident, breeding in large numbers on some of the islands in Malheur Lake, Oregon, and also on Sylvies River. Their nests are placed on the ground as well as in low bushes. They are small for the size of the bird, composed of coarse drift and small sticks, lined with strips of bark and pieces of tule. They are nearly always placed very close to the water. The eggs are four and five in number, pale green in color, and partly covered with a white calcareous matter. They average about 2.42 × 1.48 inches. There is a great deal of variation in their size, their shape is an elongated oval. The young of this species are perfectly devoid of down and feathers for the first two or three weeks, their skin is a deep glossy black throughout. These birds commence laying about April 20.

183. Larus occidentalis (Aud.). Western Gull?

I think this species breeds here, but I have not shot any specimens. A gull considerably larger than the next is quite common on the lake, perhaps var. *Smithsonianus* (Coues).

184. Larus californicus (Lawr.). Californian Gull.

A common summer resident on Malheur Lake, where it breeds.

185. Larus delawarensis (Ord.). Ring-billed Gull.

Also a common summer resident; breeds.

186. Sterna Forsteri (Nuttall). Forster's Tern.

Also common in the spring, and probably breeds somewhere in Malheur Lake.

187. Hydrochelidon nigra (Linn.). Black Tern.

A common summer resident breeding in colonies on several of the sloughs in the vicinity of Sylvies River. I obtained a number of their eggs nearly fresh, June 1, 1876.

188. Colymbus torquatus (Brünn). Loon.

Moderately common on Malheur Lake, and probably breeds there.

189. Podiceps occidentalis (Lawr.). Western Grebe.

A common summer resident on the waters of Malheur Lake, and undoubtedly breeding.

190. Podiceps auritus var. **californicus** (Hermann). American Eared Grebe.

A common summer resident, and breeding in colonies in several localities in this vicinity. I have taken a number of their nests in the season of 1876 containing from three to five eggs each.

191. Podilymbus podiceps (Lawr.). Dab-chick.

Also found on Malheur Lake, but not as common as the two preceding species; breeds.

Mr. S. H. Scudder made some remarks on polymorphism in our blue butterflies.

Mr. C. S. Minot gave a short account of the most recent investigations upon the origin of vitality in the egg.

The President announced the death of Mr. Edwin Bicknell, the well-known microscopist, and for some time a member of the Society's Council. Prof. Hyatt spoke of the excellence of Mr. Bicknell's work in the preparation of microscopical objects.

The President exhibited and presented a number of valuable minerals, and an interesting specimen of slate from Mr. W. O. Crosby, illustrating the nature of a "fault."

The thanks of the Society were voted for the gifts.

General Meeting. April 4, 1877.

The President, Mr. T. T. Bouvé, in the chair. Forty-nine persons present.

Dr. H. P. Bowditch gave an account of his investigations on the growth of children.

Prof. E. S. Morse exhibited a series of mud-wasp nests, showing a great variety of architectural design, and pointed out the opportunities for natural selection thus afforded.

The following paper was read:—

Catalogue of the Alcidæ contained in the Museum of the Boston Society of Natural History, with a Review and proposed Classification of the Family. By W. B. Barrows.

The Alcidæ, or Auks, constitute one of four families of diving birds; the other three being the Grebes, Loons and Penguins.

In these three families the hind toe or hallux is present, while in the Auks it is absent, they being the only three-toed divers. The middle toe is longest, the outer one scarcely less, while the inner is much the shortest. They are fully webbed and provided with strong claws. Both tail and wings are short, the latter when folded never reaching beyond the end of the tail. The legs are short, stout and placed far back, rendering progression graceful and easy in the water, awkward and difficult on land. The bill varies from extremely compressed to subulate, and in at least one instance is almost depressed. The nostrils are lateral, and placed near the base of the upper mandible. In life the bill and feet are often brightly colored, but the *plumage* is never brilliant, though the colors are often strongly contrasted. The winter and summer plumages are usually different, as are also those of the young and old birds, but sexual differences of plumage have not been noticed. Twenty-one species are now generally admitted by writers, and specimens of twelve of these are contained in the Museum of this Society. From a thorough study of these specimens, and a careful comparison of the writings, descriptions, and figures of all the more reliable authors, I have framed the following arrangement of the different genera and species of the family. The reasons for adopting this arrangement, and especially for the omission of the *sub-families* which most writers have used, will be found in the remarks following the descriptions of the genera and species.

I am much indebted to Prof. Alpheus Hyatt for assistance and suggestions during the preparation of this paper, and especially to Mr. J. A. Allen, of the Museum of Comparative Zoology, for his kind review and criticism of the whole.

Dr. Coues's definition of the Family *Alcidæ* (Monograph of the *Alcidæ*, Proc. Phil. Ac. Nat. Sci., 1868, p. 14) is so brief, concise, and satisfactory, that I give it entire. With this exception the descriptions are all my own.

Descriptions of Genera and Species.

Family ALCIDÆ.

"Three-toed, short-winged, short-tailed Natatores with lateral nostrils." — Coues.

Genus FRATERCULA Brisson.

Bill much compressed, upper mandible never free from irregularities in the adult; usually more or less grooved on the sides, bending over the lower at tip; culmen very convex; nostrils linear, situated in the basal half of bill, and opening just above the commissure, entirely free from feathers and separated from those of the face by a narrow, horny ridge or ribbon, from which the feathers seem to have receded, leaving the marks of their insertion in the shape of small dots which are more or less distinct in the different species, and especially on the posterior side of the ridge. This horny belt runs from the commissure to the culmen on both sides. Tarsus partly scutellate in front. Inner claw very sharp and much curved (evident, but not so marked in *F. monocerata*). Tail squarish, of sixteen feathers. Wings as usual. Total length thirteen to sixteen inches.

1. Fratercula cirrhata.

Alca cirrhata Pallas, 1769. *Lunda cirrhata* Pallas, 1811. *Mormon* (*Lunda*) *cirrhata* Bonap., Cassin. *Mormon cirrhata* Aud. *Fratercula cirrhata* Stephens, Vieillot, Gray.

Largest of the genus; bill very much compressed, three-fourths as high at base as long; lower mandible without vertical grooves, but with a longitudinal one beginning near the base close to the gonys, and extending forward half an inch or more parallel to the lower edge of the mandible, and then ending abruptly. Upper mandible with three vertical, curved grooves with their concave sides toward the point of the bill. An accessory corneous piece of about an inch in length and somewhat the shape of a date "stone," extends along the basal half of the culmen, and has the appearance of being stuck on. The horny band at base of upper mandible is only slightly elevated, but is distinctly pitted, and is broadest at the nostrils and narrows steadily toward the culmen, where it becomes reduced to a mere thread. An indication of such a ridge is seen at the base of the lower mandible, but no pits are discernible. Inner claw excessively curved, almost raptorial.

General color black, clearest above, where it is glossy, and becoming brownish on the belly. The entire face is pure white, narrowed to less than one-fourth of an inch on the forehead and at base of lower mandible, but on the sides extending all around and behind the eye, and ending on each side in a bundle of straw colored, filamentous feathers three to four inches in length, which originates just above and behind the eye, and falls backward over the sides of the neck. The only other white is a narrow line of yellowish white extending along the edge of the wing from the elbow to the carpal joint. Length 15–16 inches. Wing 7½–8½ inches. Tail 2½–3 inches. Three specimens.

Coll. La Fresnaye, No. 8130, Society's Coll., No. 9204; mounted.

No. 46492, ♀; skin; Kodiak.

No. 54717, ♀; " "

2. Fratercula corniculata.

Mormon corniculata Naumann, 1821. *Mormon glacialis* Aud. *Fratercula corniculata* Gray.

Bill extremely compressed, nearly as deep at base as long; both mandibles with vertical curved grooves two or three in number, confined to the anterior half of bill, and with their curved sides toward the point. The basal ridge very prominent on the upper mandible, narrowest at the commissure and widening toward the culmen, where it expands into a sort of plate; the pits are well shown. Nostrils as usual; in this species as in *F. cirrhata* and *F. arctica*, there are no external *rami* proper in the under mandible, and the angle of the gonys is seldom, if ever, well marked. There is a slender leathery spur, three-eighths of an inch in length, on the upper eyelid, and a similar, but shorter and broader one, on the lower.

Above, black; top of head rather dark ash, the line of demarkation between this color and that of the back very clearly defined on the nape. The black of the back extends in a collar round the neck, and reaches the bill on the chin, extending up to the angle of the mouth, where it becomes ashy. Sides of face pure white, extending all around the eye, and sometimes in a narrow line almost over the back of the neck between the black of the back and the ash of the head. Breast and belly pure white; a whitish line along the edge of wing as in *cirrhata*. Length $14\frac{1}{2}$–$15\frac{1}{2}$ inches. Wing 7–8 inches; tail 2–3 inches. Five specimens.

No. 54720, skin; Kodiak.
" 54721, " "
" 54723, " "
" 54724, " "
Collector's No. 159, ♂, skin; St. Michaels.

3. Fratercula arctica.

Alca arctica Linn., 1758. *Lunda arctica* Pall. *Fratercula arctica* Stephens. *Mormon arctica* Illiger.

Very similar to *F. corniculata*, but rather smaller; the bill viewed from the side has a more triangular shape, the culmen being, as a rule, less convex. The grooves, which are four or five in number, are less nearly vertical, the basal one beginning almost at the base of the culmen and ending at the anterior point of the nostril. The basal ridge is of the same width throughout, and distinctly pitted. The bill as a whole, is decidedly smaller. The eyelid appendages are much shorter and broader. The distribution of color is exactly the same, with the exception of the black collar, which in this species never reaches the bill. The top of the head is perhaps a little darker, and the white of the face less pure; there are also darker maxillary patches; otherwise the two species are precisely similar. Length 13–14 inches. Wing $6\frac{1}{2}$–7 in.; tail $2\frac{1}{4}$–$2\frac{1}{2}$ in.

A young specimen about two-thirds grown shows marked differences from the adult, especially in the bill, which is rather more than twice as long as deep at the base, with culmen regularly convex, angle of gonys very marked, and rami of lower mandible perfectly evident though rather short. The basal half of the upper mandible, with the exception of the culmen, was evidently soft and membranous in life, and a tract of similar size on the lower mandible was evidently softer than the remainder of that part. There is no indication of the pitted ridge at the base of the upper mandible. The areas of color are about the same as in the adult, but the colors themselves are much duller and less distinct. In other respects it is similar to the adult. Five specimens.

Coll. La Fresnaye, No. 8131, Society's Coll., No. 9205; N. Atlantic; mounted.

Coll. La Fresnaye, No. 8132, Society's Coll., No. 9206; N. Europe; mounted.

Coll. La Fresnaye, No. 8133, Society's Coll., No. 9207; N. Atlantic; mounted.

Coll. La Fresnaye, No. 8134, Society's Coll., No. 9208; N. America; young; mounted.

Duplicate, no number; Dr. Shattuck.

4. Fratercula monocerata.

Alca monocerata Pall., 1811. *Cerorhina monocerata* Cassin. *Ceratorhina* (*Uria*) *occidentalis* Aud.

Bill strongly compressed; lower mandible entirely smooth on its sides; upper one smooth as far back as anterior point of nostrils, where begins the root of a "horn," which seems to be saddled on the base of the upper mandible, and rises about one-third of an inch above the culmen. The part of the horn which extends down on the side of the bill is a little above the level of the remainder of the lateral surface of the bill, and thus a slight furrow is produced, which is curved, and has its concave side toward the point of the bill; just in front of this furrow, the surface is slightly wrinkled. The base of the horn is a little wider than the nostril which opens beneath it, but it narrows toward the apex, which is rounded. The size and extent of the horn, in the direction of the length of the bill, varies very much in different individuals, but it is always strongly compressed. Between the posterior margin of the horn and the line of feathers, there is a narrow band of unfeathered, horny membrane, which evidently replaces the punctate ridge found in the three preceding species. The culmen is decidedly convex; the gonys slightly concave; just at its angle, which is well marked, and partially separating the rami, which are evident, is a supernumerary corneous piece from one-fourth to one-half an inch in length, and about one-sixteenth of an inch in depth, which looks as though moulded on after the full development of the rest of the bill.

The general color above is black, most glossy on the back and wings, rather duller on the head, and changing gradually to dark ash on the sides of the head and neck and on the throat; the color becomes lighter on the breast, and so extends along the sides to the flanks. The belly and under tail coverts are nearly pure white. There are two sets of stiff, lanceolate, white feathers on the sides of the head; one originating just over the eye and running straight backward; the other beginning near the angle of the mouth and extending down the side of the neck. These feathers vary from $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches in length.

So far as I am aware, this species has never before been placed in the same genus with *F. arctica*, having usually monopolized one entire genus. Its relationship is unquestionably nearest to the Puffins, and it shows so many of the characteristics of this group that I have been led to rank it as only another species of the genus Fratercula. In many points it seems to be intermediate between the Puffins and the Phaleridine group. Thus the outer claw, though much more curved than in any other genus, is not so much so as in the other members of this genus, while the bill lacks the deep sulcations so prominent in them. But the structure of the bill, the size, the feet and claws, the number of the tail feathers, and, in short, the entire *make-up* of the bird, is sufficient in my estimation to identify it with this genus. Two specimens.

Donation No. 1726; Bryant's Coll.; immature.

No. 46521, adult ♂; Sitka.

Genus Phaleris[1] Temminck.

Species not exceeding ten inches in total length, and with the nostrils entirely unfeathered. Usually with a crest, or with elongated feathers about the head. Bill variable; sometimes simple, oftener irregular, with various elevations and depressions, often with nodules or other accessory elements; always stout, more or less compressed, shorter than the head, the culmen convex, tip acute. Wings and tail of ordinary shape and length. Feet small and short; tarsus compressed, reticulate, shorter than the middle toe.

The genus thus considered contains the following species:

5. Phaleris psittacula.

Alca psittacula Pallas, 1769. *Phaleris psittacula* Temminck, Stephens, Bonaparte, Gray. *Omtria psittacula* Eschscholtz. No specimen.

6. Phaleris cristatella.

Alca cristatella Pallas, 1769. *Alca tetracula* Pallas. *Simorhynchus cristatellus* Merrem, Brandt, Coues. *Phaleris cristatella* Audubon. *P. tetracula* Steph.

[1] As I have examined only one species of this genus, I give essentially the generic description of the genus Simorhynchus, by Dr. Coues, only wording it so as to include *P. aleutica*, which he refers to the genus Ptychorhamphus Brandt, but which seems to me to belong properly with the forms here included. (See Proc. Phil. Ac. Nat. Sci., 1868, p. 34.)

Bill short, not very much compressed, as deep as long. Culmen very convex, tip bending over the point of lower mandible very slightly; angle of gonys well marked; rictus very irregular. A horny plate at the angle of the mouth which, when the bill is closed, appears to be merely a continuation of the broad, bare side of the lower mandible. This plate is said to be wanting in winter and in young birds, and in this condition the bird has been described under the specific name of *tetracula.* Nostrils rather prominent, irregularly oval in shape. A recurved crest of from twelve to twenty narrow brown or blackish feathers rises from the forehead and curls over upon the bill. A series of very slender, filamentous, white feathers extends from under and behind the eye down the side of the neck. General color brownish, becoming almost black on the back, lighter and almost ashy on the breast and belly. No white anywhere except the filamentous feathers on the side of the head. Length about 9 in.; wing 5–5½ in. One specimen.

Coll. La Fresnaye, No. 8135, Society's Coll., No. 9209; Kamtschatka.

7. Phaleris camtschatica.

Alca camtschatica Lepechin. *Phaleris camtschatica* Brandt, Gray, Cassin. *Simorhynchus camtschaticus* Schlegel. No specimen.

8. Phaleris pusilla.

Uria pusilla Pallas, 1811. *Phaleris microceros* Brandt, Cassin. *Phaleris nodirostra* Bonaparte, Audubon, Gray. No specimen.

9. Phaleris aleutica.

Uria aleutica Pallas, 1811. *Ptychorhamphus aleuticus* Brandt, Bonaparte, Cassin, Elliot. *Phaleris aleutica* Gray. *Mergulus Cassinii* Gambel. *Arctica Cassinii* Gray. No specimen.

Genus Mergulus (Ray) Vieillot.

Bill variable in length and degree of compression; never excessively compressed, in one species hardly at all. Culmen always convex. Nostrils oval or circular, placed in an evident fossa and reached but not covered by feathers. Tarsi more or less compressed; distinctly scutellate in front.

10. Mergulus alle.

Alca alle Linnæus, 1758. *Mergulus melanoleucus* Ray. *Uria alle* Pallas, Temminck, Audubon. *Mergulus alle* Vieillot, Gould, Bonaparte, Cassin, Verrill, Coues.

Bill hardly, if at all, compressed; about as broad at base as long; culmen quite convex, broad and rounded; tomial edge of upper mandible considerably inflected. Gonys very short; feathers extending between the rami as far as the angle. General form very stout and full; wings rather longer than usual. Color in summer dark bluish black above, extending all over the throat and down on the breast; rest of under parts clear white; scapulars edged, and secondaries tipped, with white. In winter and in young birds, the white of the belly extends to the bill and around the sides of the neck, sometimes, especially in the young, meeting on the nape. As generally seen, there is a mixture of black and white feathers on the upper part of the breast, and almost always the flanks are streaked more or less with black or brown. In some specimens there is a speck of white over the eye. Length about $8\frac{1}{2}$ in. Wing $4\frac{1}{4}$–5 in. Six specimens.

Coll. La Fresnaye, No. 8144, Society's Coll., No. 9218; Russia.
Coll. La Fresnaye, No. 8145, Society's Coll., No. 9219; Arctic Sea.
Coll. La Fresnaye, No. 8146, Society's Coll., No. 9220; N. Atlantic.
Duplicate, No. 1, ♂; mounted; Boston, Mass., 1871.
" " 2, ♀; " " " "
" " 3, ♀; skin " " "

11. Mergulus antiquus.

Alca antiqua Gmelin, 1788 (from the "Antient Auk" of Pennant, 1785). *Uria antiqua* Audubon. *Synthliborhamphus antiquus* Brandt. *Brachyrhamphus antiquus* Gray. *Uria senicula* Pallas. *Mergulus cirrhocephalus* Vigors. No specimen.

12. Mergulus wurmizusume.

Uria wurmizusume Temminck. *Brachyrhamphus Temminckii* Brandt, Gray. No specimen.

Genus BRACHYRHAMPHUS Brandt.

Small, slenderly built. Bill slender and somewhat compressed; culmen convex; sides of upper mandible much inflected, with the peculiar, tooth-like groove near the point, so noticeable in Lomvia; the tip somewhat overhanging. Nostrils small, oval or circular, reached and partly covered by feathers. Tarsus entirely reticulate.

13. Brachyrhamphus marmoratus.

Brachyrhamphus marmoratus Brandt, Cassin, Gray. *Uria Townsendii* Aud. *Colymbus marmoratus* Gmelin.

Bill very slender; lower mandible with a groove on the side near the base; both mandibles with the edges much inflected; most so near the base in the upper, and near the tip in the lower. Color—on the head above nearly black; feathers on the forehead with indistinct ashy tips. Wings above blackish, with some ashy-tipped feathers. Entire back, rump, and tail feathers finely banded transversely with alternate bars of black and rusty red or chestnut. Beneath, similarly banded with white and blackish, the markings rather coarser. Under surface of wing clear ash. Length 10 in. Wing 5 in. One specimen.

No. 46555, ♂, spring plumage; Sitka.

14. Brachyrhamphus Kittlitzii.

One of Brandt's species, not well known. No specimen.

Genus Uria (Moehring) Brisson.

Bill straight, somewhat compressed; culmen straight except near the tip; tip of upper mandible slightly overhanging that of lower; lower mandible with a lateral groove near its base. Nasal fossæ deep and long, extending far in front of the linear nostrils, where the feathers cease, leaving the forward part of the groove bare. Nostrils reached, but only partially obscured, by the feathers. Tarsus entirely reticulate. Color — in summer dark, both on back and belly; in winter showing more or less white on both, especially on the belly, which is usually entirely white.

15. Uria grylle.

Alca grylle Linn., 1758. *Uria grœnlandica* Brünnich. *Uria grylle* Brunnich, Latham, Temminck, Vieillot, Bonaparte, Audubon, Brandt, Gray, Cassin, Bryant, Coues, etc., etc.

Bill most slender of the genus; not noticeably compressed. Color — in summer, sooty or plumbeous black, with a greenish gloss; wings and tail clear black above, with the exception of a large patch of white on the wing coverts; under side of wing clear white. In winter the whole under parts are clear white; the upper parts mostly mottled with black and white, with the exception of the wing and tail feathers, which generally retain their clear black. Intermediate seasons show all the different degrees of mottling, and among others a black bar through the white wing spot is not uncommon. Tail feathers *twelve*. Length 13 in. Wing $5\frac{1}{2}$–$6\frac{1}{4}$ in. Tail 2 in. Seven specimens.

Coll. La Fresnaye, No. 8141, Society's Coll., No. 9215; N. Europe.

Coll. La Fresnaye, No. 8142, Society's Coll., No. 9216; N. America.

Coll. La Fresnaye, No. 8143, Society's Coll., No. 9217; Arctic Ocean.

No. ——, winter plumage.

No. ——, summer plumage; Dr. Wm. Ingalls.

No. ——, July; Sukkertoppen, Greenland.

No. ——, Mass. T. Jackson.

16. Uria columba.

Uria grylle, variety *B*, Latham. *Cepphus columba* Pall., 1811. *Uria columba* Cassin.

Very similar to the preceding, averaging a little larger. The bill is stouter and more obtuse. The general color is about the same; the white spot on the wing is interrupted, and sometimes entirely severed, by a band of black. The under wing is never pure white but is sometimes very light, as is shown by some of the Museum specimens. The tail feathers are *fourteen* in number. This species seems to replace *U. grylle* on the Pacific coast. Length 13 in. Wing 7 in. Tail 2–2½ in. Six specimens.

No. 46534; ♂; skin; Sitka.

No. 54291; ♀; " Kodiak.

No. 54746; " "

No. 54748; " "

No. 54750; " "

Duplicate, no number; Bryant's Coll.

17. Uria carbo.

Cepphus carbo Pallas, 1811. *Uria carbo* Gray, Cassin, Coues, etc. *Alca carbo* Schlegel. No specimen.

Genus Lomvia (Ray) Brandt.

Size large; bill rather long, slightly curved, considerably compressed; culmen gently convex; rictus straight at first, but deflected toward the tip; gonys slightly concave. Upper mandible with a tooth at tip from which a little groove runs backward on the side of the mandible parallel with the culmen. Nasal fossæ very short, almost completely filled with feathers, beneath which the nostrils are just visible. There is a long furrow in the feathers behind the eye. Tarsus shorter than middle toe; almost entirely scutellate in front. Colors — dark above; white below. Secondaries white tipped.

18. Lomvia troile.

Colymbus troille Linnæus, 1761. *Uria troile* Latham, Temminck, Gould, Gray, Naumann. *Lomvia troile* Brandt, Coues. *Cepphus lomvia* Pallas.

Bill longer than tarsus, its depth at nostrils much less than half the culmen. Tomia of mandibles somewhat inflected near the angle of mouth, but mostly feathered. Color in summer dark glossy olive-brown all around the head and neck, shading into duller and blackish colors on the back, wings and tail. Entire under parts, from the upper part of breast, pure white, sometimes streaked on the sides and flanks with brown or black. Some specimens have a ring round the eye, and a line behind it, white (this is variety *ringvia*). In winter, and in young birds, the white of the under parts extends to the bill, and sometimes even up the sides of the face beyond the eye, leaving, however, a dark line behind the eye. Length 16–18 in. Wing 8 in. Tail 2 in. Seven specimens.

Coll. La Fresnaye, No. 8136, Society's Coll., No. 9210; N. Europe; mounted.

Coll. La Fresnaye, No. 8137, Society's Coll., No. 9211; N. America; mounted.

Coll. La Fresnaye, No. 8138, Society's Coll., No. 9212; Arctic Sea; mounted.

Coll. La Fresnaye, No. 8139, Society's Coll., No. 9213; N. Europe; young; monnted.

Coll. La Fresnaye, No. 8140, Society's Coll., No. 9214; North Sea; young; mounted.

No. 54770; skin; moulting; Kodiak.

No. ——, Mass. Dr. Wm. Ingalls.

19. Lomvia arra.

Cepphus arra Pallas, 1811. *Uria Svarbag* Brünnich. *Uria Brünnichii* Sabine, Temm., Bonap., Nutt., Gould, Aud., Gray.

Very similar to *L. troile*, but the general form stouter and more thick set. The bill is very much shorter; length of culmen only about twice the depth of bill at nostrils. The culmen is more abruptly convex in this species than in *L. troile*, and the nasal fossa is broader and extends further in front of the feathers, though the nostrils are still completely covered. The tomia of upper mandible back of the nostrils is bare of feathers and considerably dilated, a very noticeable feature, especially in life, when it is said to be white, the rest of the bill being dark. The distribution of colors is almost precisely like that of *L. troile*, but in the only specimens I have examined the head and back are much darker, being almost jet black with a bluish tint especially on the head and hind neck, and becoming rather duller on the back. The seasonal changes are said to be nearly the same as in *L. troile*. Length 18 in. Wing $8\frac{1}{2}$ in. Four specimens.

Two in winter plumage, mounted.

No. 54772; summer, moulting; Kodiak.

No. ——, winter plumage; mounted; Mass. coast.

Genus ALCA Linnæus.

Size large; bill large, strong, much compressed, with vertical curved furrows on the sides of both mandibles. Culmen strongly convex; gonys slightly concave, with the angle rather rounded but distinct. Tip of upper mandible more or less overhanging that of lower. Rictus very long, its sides unfeathered almost or quite to the angle of the mouth. There is a deep groove at the base of the upper mandible parallel to the outline of feathers, and separated from them by a narrow ridge, which runs from the base of the culmen almost to the commissure, with the edge of which it forms an angle of about 45° or 50°. Just at the apex of this angle the linear nostril begins, and extends backward parallel to the lower side, and completely covered by the short, thick feathers. Tarsus scutellate in front. Tail of twelve or fourteen feathers, rather long and pointed. Color — head and neck all around dark, as are also the back, wings and tail. Breast and belly white; some white on the face, and secondaries white-tipped.

The genus, as here framed, admits both *A. impennis* and *A. torda*, for although they have been separated by many writers on account of the imperfect wings of *A. impennis*, which prevent its flying, yet they are so exactly similar in all other essential points that I can see no reason whatever for placing them in separate genera.

20. Alca impennis.

Alca impennis Linnæus, 1758, Brünnich, Latham, Gmelin, Pallas, Temminck, Gray, Stephens, Audubon, Schlegel, Brandt. No specimen.

21. Alca torda.

Alca torda Linnæus, 1758, Brünnich, Pallas, Audubon, etc. *Utamania torda* Leach, Stephens.

Bill short, very deep and much compressed. Culmen regularly convex, usually from the very base. Point of upper mandible fairly meeting that of the lower, but the line of commissure is so much and so suddenly bent downwards as to make the bill appear almost hooked. There are usually three or four furrows in the upper mandible which are much curved, and have their convex sides toward the point of bill. The same number (or one less) usually occurs on the lower mandible, but they are almost, or absolutely straight. The basal of these furrows is generally white, and shows in strong contrast to the black of the rest of the bill. Feet as usual; tail of twelve feathers; wings long, pointed and fully developed. Color in summer almost precisely as in the preceding genus, but there is a very narrow white line extending from the base of the culmen to the eye. In winter, and in the young, the same changes of plumage take place as in Lomvia, though the white line on the face seldom disappears entirely. The bill of the immature bird is totally different from that of the adult, as will elsewhere be shown. Length 18 in. Wing 7–8 in. Tail 3½ in., with the central feathers 1¼ in. longer than the lateral ones. Six specimens.

Coll. La Fresnaye, No. 8124, Society's Coll., No. 9198; summer plumage; Arctic Sea.

Coll. La Fresnaye, No. 8125, Society's Coll., No. 9199; summer plumage; N. Europe.

Coll. La Fresnaye, No. 8126, Society's Coll., No. 9200; winter plumage; N. America.

Coll. La Fresnaye, No. 8127, Society's Coll., No. 9201; winter plumage; N. Europe.

Coll. La Fresnaye, No. 8128, Society's Coll., No. 9202; young; N. Europe.

Coll. La Fresnaye, No. 8129, Society's Coll., No. 9203; young; North Sea.

REMARKS ON THE ARRANGEMENT AND CLASSIFICATION OF THE MEMBERS OF THIS FAMILY.

Several modern ornithologists, notably Brandt, Cassin, Gray and Coues, have attempted to divide the family *Alcidæ* into two or more sub-families. Brandt was the first to propose such a division, and he made two sub-families, placing the species in the one or the other according as they had feathered or unfeathered nostrils. Cassin's classification was a modification of this arrangement; while Coues and Gray, taking the general characters of the whole bill for their basis, made three sub-families. The principal objection which Dr. Coues makes to the arrangement of Prof. Brandt, is that it brings the Guillemots (*Lomvia*) next the typical Auks (*Alca*); whereas he asserts that *Alca* and *Fratercula* are more closely related, and that *Alca* and *Lomvia* should stand at opposite ends of the chain or series. For, however much these two authors differ with regard to sub-families, both agree that the genera and species of Auks do form a continuous chain which seems to take the form of a circle, and the only question is as to the number of parts into which this circle shall be divided, and at what points the dividing lines shall be drawn. The order in which it seems to be agreed the links of this chain shall stand, is as follows: *Alca*, *Fratercula*, *Lunda*, *Ombria*, *Phaleris*, *Mergulus*, *Brachyrhamphus*, *Uria*, *Lomvia*.

Essentially this order is accepted by both Brandt and Coues, but the former begins with *Alca* and then passes to *Lomvia*, and so through the series, ending with *Fratercula*; while the latter puts all the other forms between *Alca* and *Lomvia*. I cannot, and I do not try to, reconcile the grouping of these two authors, for I do not think the family can be subdivided into groups higher than generic; I think the circle should be left unbroken. That the "three groups" of Coues do "stand forth with tolerable distinctness," may be a fact, but the groups seem to me to rest on superficial characters, for I believe that *Alca* is much more closely related to *Lomvia* than to any other genus, and indeed so closely related that the two forms ought not on any account to be separated — certainly not placed in two different sub-families. The adult forms do not, it is true, at the first glance, very much resemble each other; but between the immature, though almost full grown *Alca torda*, and the adult of *Lomvia arra*, there is a resemblance which is something more than superficial or accidental. And yet, striking as is this resemblamce, it is, if we are to credit Naumann, even more striking in the young in the downy plumage. He says (Naturg. Vög. Deutschl., XII, p. 536) "the nest-plumage of young of this species (*Lomvia arra*) so much resembles that of others that they are only to be distinguished by the still shorter little bill, when they can be compared side by side with those of the same age. But again, on the other hand, the bill in the first week of life resembles that of the young *Alca torda* so much, that their dark colored throats alone distinguish them from the latter."

In size, habits, color, and general structure, these birds are nearly identical, as will be seen by a comparison of the descriptions; almost the sole definite point of marked difference is found in the bills of the adult, and our specimens show that up to a very late period of development, long after all other characteristics of youth, save color, have given place to adult characters, the bill of *Alca torda* preserves its remarkable resemblance to that of *Lomvia arra.*

If, now, we compare the bill of the adult *Alca impennis* with that of the adult *Alca torda*, we find the latter much deeper in proportion to its length, though the resemblance is very striking; if, however, we compare it with the bill of a young *Alca torda*, two thirds grown, we shall find that the bill of *A. impennis* is merely an enlarged copy of that of *A. torda*, with perhaps a very slight difference in the feathering of the nostrils, and the addition of the sulcations of the bill. If such resemblances mean anything in the one case, they must in the other. If now we take the young of the different members of the genus *Fratercula* we shall find in the bills of all a strong similarity to *each other*; but if we compare them with the genus *Alca*, we nowhere find a resemblance even approaching that of *Alca* to *Lomvia.*

The similarity of the young bill of *F. monocerata* to the bills of young of *F. arctica* and *F. cirrhata*, is one of the points which has led me to include all these (as well as *F. corniculata*, the young of which I have not seen) in one genus; although I am perfectly well aware that *F. monocerata* has hitherto almost always been allowed a genus to itself.

In gathering all the small Phaleridine forms under one generic name, I have also departed from the usual custom of authors, but nearly the same reasons have influenced me, which led Dr. Coues to gather so many of these same species under the genus *Simorhynchus.* He says (Proc. A. N. S. Phil., 1868, p. 35), "The various species are all nearly identical in the structure of the wings, feet, and tail; in the bill no two entirely agree. Each presents *suæ speciei* characters in the shape of the bill; but the very fact that this organ varies so much seems to indicate that the differences are no more than of specific importance." I have merely carried the principle a little farther, including one more species than did Coues, viz., *aleuticus.*

The bill of the young in all species of Auks is simpler than in the adult, and so far as I have been able to observe, it has a strong tendency, in almost all, to become more slender. This would seem to group the Auks about one central point, but thus far I have been unable to discover the centre toward which these indications point. From lack of sufficient specimens I am unable to do more than indicate what has seemed to me to be a tendency toward a slender type of bill. In the study of this family I have been more and more deeply impressed at every step with the conviction that the key to its true classification will be found in a thorough investigation of the embryology of the group. Until this is done, it seems to me probable that our best efforts can only result in very moderate success, while absolute certainty of the true affinities of the species must be unattainable in any other way.

Section of Botany. April 11, 1877.

Mr. B. P. Mann in the chair. Fifteen persons present.

Dr. G. L. Goodale exhibited a small cruciferous plant, *Draba caroliniana*, recently discovered in Salem; also a specimen of *Corylus hyalinus*, closely related to our species.

General Meeting. April 18, 1877.

Vice-President Mr. S. H. Scudder in the chair. Forty-one persons present.

Mr. Charles Sedgwick Minot gave an account of the recent investigations of embryologists on the formation of the germinal layers and the phenomena of impregnation among animals.

Mr. Minot reviewed the various observations which had been made and the conclusions which could be already drawn. Hæckel was the only person who had hitherto attempted a general retrospect of the work done in this field; he had promulged the Gastræa theory, which cannot be accepted because it does not agree with the known facts, and Hæckel has been able to maintain it only by a long series of misrepresented statements. Mr. Minot rejected the Gastræa theory for these reasons, but did not attempt to replace it, although he wished to point out peculiarities hitherto overlooked in spite of their being common to all forms of embryonic development.

In almost every case the entodermic cells are larger and less numerous than those of the ectoderm. This distinction is obviously necessary on account of the mutual relations of the two primitive layers. The ectoderm has to grow around the entoderm, which it can do only by acquiring a greater superficial extension — this the ectoderm does by dividing very quickly at first into small cells. After the entoderm is fully enveloped it may then continue to grow until its superficies is much greater than that of the outer layer, within which, however, it still finds room by forming numerous folds, thus gradually reaching the condition of the higher adult animals, where the intestine sometimes has an enormous surface, but is nevertheless contained within body walls presenting much less surface. It is therefore only during the early stages of the segmentation of the yolk that we find the hypoblast expanding more slowly than the epiblast.

The difference between the two rates of growth is very variable. Among the Molluscs there collects a small amount of finely granular matter at one pole of the egg, while the rest is filled with large and numerous nutritive granules imbedded in a fine protoplasmic network. It is well known, through the observations of Lacaze-Duthiers on Dentalium, Flemming on Lamellibranchs, Fol on Pteropods and Heteropods, Lereboullet, Lovén, Strecker, Leydig, and R. Lankester, etc., on various other Molluscs, that this finely granular matter (*Bildungsdotter*, formative substance) segments rapidly, forming the ectoderm and enclosing the yolk, which meanwhile divides into only a few large cells, which vary greatly in size and number in different species, but in all cases enter into the composition of the entoderm. It is important to recollect that the yolk in the instances above cited, is contained in cells belonging to the inner germinal layer. It is further known that both primitive layers are continuous, forming a vesicle (*Blase*) within which there is a cavity filled with cells that ultimately make the mesoderm. In all cases where the process of segmentation occurs in such a way as to construct a single walled vesicle, one pole forms the ectoderm, the other the entoderm; when, however, no yolk granules are developed the difference in the two rates of growth or segmentation is much less marked. Thus in the Echinoderms, during the planula stage, the cells that ultimately compose the ectoderm divide more rapidly than the others — consequently the cells destined to become the walls of the primitive digestive cavity appear larger. The same distinction appears among certain Nematods, and even in so aberrant a form as Cucullanus according to Bütschli, as likewise among the Ascidians and Amphioxus (Kowalewski) and Bryozoa (Schmidt). Development by invagination occurs also among the Coelenterates, but no accurate figures or descriptions have ever been published of those stages in which the difference in size of the cells ought to be seen, so that we cannot say whether this division of animals conform, or are exceptions, to the general rule. Among the sponges the distinction between the two parts of the vesicular embryo is well marked (*cf.* the recent publications of F. E. Schulze, Barrois, Mecznikow, Carter, Keller, Schmidt and Hyatt). It is very decided in Halisarca, but most striking in the calcareous sponges, the embryos of which are nearly spherical, one hemisphere consisting of small cells without large granules, the other of very large cells containing a great deal of *lecithe* (*dentoplasm* of Éd. van Beneden). The same peculiarities have been described also in Planarians, whose eggs exhibit the finely granular fast growing ectoderm at one pole (Girard, Keferstein).

In all these cases a vesicle is formed by a single layer of cells, of which there are two kinds: around one pole small ectodermic cells growing out of a finely granulate protoplasm; around the opposite pole larger cells, which segment more slowly and frequently contain a large amount of nutritive matter (*Nahrungsdotter*, lecithe, dentoplasm). This mode of development may be distinguished as polar, a term including epibolie, embolie, and all forms of invagination.

There is a second mode of segmentation, generally known as delamination, which leads to the formation of double walled vesicles. Fol has studied the process of delamination in the Geryonidæ, the only instance in which the changes occurring during this mode of development have been followed in detail; nevertheless it can already be positively affirmed that the same difference of growth emphasized above reoccurs here also. The ectoderm consists of small cells, the enclosed entoderm (or yolk) of large cells, often with much nutritive matter. Mr. Minot referred also to the observations of Leuckart and others on Nematods and Platyhelminths, Villot on Gordius, A. Agassiz, Kowalewski and Fol on Ctenophoræ, Éd. van Beneden on Gammarus, Selenka on Phascolosoma, etc.

In the case of Annelids and Vertebrates the development is rendered much more complicated through the singular formation of the body-axis. If we return for a moment to the Cephalopods, we find that they are distinguished by the yolk (*Nahrungsdotter*) not segmenting as a whole, but remaining as one large continuous mass, which, according to the recent observations of Ulianin and Ray Lankester, forms part of the wall of the alimentary canal, the rest of which arises from the yolk by the separation of small cells. The same thing occurs among Vertebrates (*e. g.*, fishes and birds), while in others, as among the Annelids, the yolk divides (*e. g.*, Batrachia, Mammalia). In the former case, as for instance in fishes, the so-called embryonic disc is the ectoderm, the yolk the entoderm, while that which lies between is not hypoblast, as it is usually called, but mesoblast. When the infolding of the embryonic rim (*cf.* His, Balfour and Oellacher) begins the formation of the chorda dorsalis and of the nervous system, then small cells separate from the yolk and form underneath the axis the upper wall of the primitive gut, while the yolk itself makes the lower wall (*cf.* Balfour, on the early stages of Vertebrates, Journ. Anat. Physiol., x). Ranber has made it very probable that the same form of axial growth which occurs in Teleosts and Selachians reoccurs in the chick, and probably in all Vertebrates. It can be shown that it really is so in frogs. It is this mode of axial infolding [1] which causes the so-called bigeminal evolution of Vertebrates, certainly at least in the lower forms. The same phenomenon has been traced in some Annelids (leeches, growing anal end of naids, and in the budding zones of some Oligochæta). It may be considered probable that this mode of embryonic development will be found to be the most important and general characteristic of segmented animals. Among all the chordate animals the difference between the yolk and formative substance (*Bildungsdotter*) has been long known, and the collection of the finely granular matter at the pole where the small ectodermic cells are first segmented off has been frequently pointed out. In other cases the development is not polar but by delamination. Even in these instances the ectodermic cells are smaller than the others (*vide* Bischoff, Kölliker, Hensen, and Éd. van Beneden, on mammals, Stricker, Bambeke and Goette on batrachians). It must, however, be borne in mind that we are still far off from understanding the development of the mammalia because the origin of the chorda dorsalis has never been determined.

Concerning the segmentation of the eggs of Arthropods so little is known, that nothing further can be affirmed than that the outer

[1] Semper in his memoir on "Strobilation and Segmentation," (Semper's Arreiten, Bd. iii) calls the axial infolding "Verwachsung der beiden Keimstreifhälften."

layer of small protoplasmatic cells, usually called the blastoderm, corresponds to the ectoderm. Nothing definite is known about the yolk in Arthropods; if we judge from analogy it will be found to belong to the entoderm; at all events it forms large cells with much nutritive matter. The supposed superficial segmentation is merely apparent; the observations which sustained it are all evidently incomplete, and in some cases have already been disproved (Spiders, Ludwig; Crustacea, van Beneden, Bobretzky, Dohrn, etc.).

From all these instances we conclude that *the yolk undergoes in all animals a total segmentation, during which the cells of the ectoderm divide faster and become smaller than the cells of the entoderm.* According to Kowalewski's observations the Brachiopoda and Sagitta are exceptions to this rule, — the only ones of importance Mr. Minot had found. Renewed investigations may show that Kowalewski's figures are not quite exact.

All the known variations in the process of segmentation depend merely upon: 1, the degree of difference ot size of the two sets of cells; 2, the time when the difference appears; 3, the mode of development, whether polar, or by delamination, either of which may or may not be accompanied by axial infolding. In Gasteropods, Planarians, Calcispongiæ, Gephyrea, Annelida, fish, birds, and Arthropods, the difference is great and appears early. In Echinoderms, most Cœlenterates, some sponges, in Nematods, Amphibians, etc., it is less marked and appears later. This stage of development is common to all Blastozoa, and appears, according to van Beneden, even in the Dicynema. The term *Diaderm* may be used to designate it. Whether the development is polar or peripheral, *i. e.*, by delamination, the space between the two divisions of the *diaderm* is that in which the mesoderm develops. When delamination takes place the segmentation cavity is the entoderm cavity; when, on the other hand, the segmentation is polar, the cleavage cavity is that in which the mesoderm is formed.

The two parts of the diaderm originate, as we have seen, in different portions of the egg. In some instances the finely granular substance that generates the ectoderm collects at one pole, and the segmentation becomes polar; in other cases it remains distributed over the whole surface of the egg, and delamination results. Peripheral development is to be provisionally regarded as the primitive mode, because it has been observed in three instances (Lamellibranchs, Flemming; perch and chick, Oellacher) that the finely granulate protoplasm is at first distributed around the whole egg, and subsequently only collects at one pole.

It is possible therefore that every egg consists, like a protozoön, of an endoplasm and ectoplasm. In this connection it becomes particularly interesting to call attention to another resemblance between eggs and Infusoria. Engelmann and Bütschli by supplementing the observations of one another, have made evident the real nature of the process of reproduction in the Infusoria, showing that the so-called nucleolus acts as a male element, passing with a little protoplasm at the time of conjugation into another infusorium, which usually reciprocates the process. After conjugation the Infusoria both go on dividing asexually for several generations, apparently until they become so exhausted that a new conjugation is necessary. Now in the case of eggs, impregnation, as has been abundantly proven by the recent observations of Hertwig, Éd. van Beneden and Fol, is effected by a spermatozoön entering the yolk, where it unites with the nucleus (female pronucleus), upon which the egg divides into numerous cells, just as in the Infusoria, with this difference only that the cells remain together instead of separating to form independent individuals. Now, in the case of the Infusoria the animal prepares for impregnation by throwing out its own male element, or a nucleus with a little protoplasm — eggs prepare to receive the spermatozoon by ejecting as direction-cells (*Richtungsbläschen, globules polaires*) a nucleus with a little protoplasm. *The Richtungsbläschen are comparable to the nucleoli of Infusoria.* A further confirmation of this homology is offered by the formation of the "*Kernspindel,*" as introductory alike to the ejection of the direction-cells and the expulsion of the nucleoli (Bütschli, Hertwig, Fol, Flemming). We distinguish therefore equally in both cases *the formation of a generation in which the two sexes are separate cells, and then the union of two sexual unicellular individuals, of different origin, to form an asexual cell, which then goes on dividing asexually for many generations* until the original energy is exhausted. The sexual generation may be called *genoblasts,* the female *arsenoblasts,* the male *thelyblasts* (direction cells, nucleoli of Infusoria and spermatozoa). It therefore appears that a real alternation of generations occurs throughout the animal kingdom — a law which is already well established for plants

In accordance with the view just advanced, the egg becomes really female only upon the discharge of the male direction-cells; up to that time it contains the elements of both sexes. Likewise all the cells of the body must be both male and female since they arise by asexual division from an impregnated egg, or a cell in which the sexes are united. It is important from this standpoint to know whether in the development of the spermatozoa the mother cell breaks up into two portions, one of which becomes the male part, while the other remains separated. There are but few observations which can be used here, but those few fulfill our expectations, for they describe a "*Mutterkern*" (female element?) which remains behind and is aborted, while the numerous spermatozoa-nuclei continue their life independently.

It is curious that the male elements are always more numerous than the female; in the Infusoria the nucleoli exceed in number the nuclei, in eggs there are usually three direction cells, and from one *Mutterkern* there arise numerous spermatozoa heads.

It is further to be added that the theory above defended permits a new hypothesis of parthenogenesis, namely: that it is a special form of asexual reproduction or division.

Prof. John McCrady spoke of the value of many of Mr. Minot's suggestions, and indicated some points on which he held different views. He also presented the following papers:—

A Provisional Theory of Generation. By John McCrady.

The course of development in animals is generally admitted to be one of differentiation, such that normally the more highly specialized forms succeed to, and arise from, the less specialized, the heterogeneous following the homogeneous, the complex superseding the simple. Even Harvey, in the infancy of our modern embryology, perceived and expressed this truth, though he did not make it a conspicuous feature of his theory, reserving that prominence for his peculiar conception of Epigenesis. Von Baer, who, however, made the unfortunate mistake of asserting that the Special is derived from the General—substantially embraced and maintained this, the true doctrine. Since that time it has met with general, though often silent acceptance, and has been recently adopted by Mr. Herbert

Spencer in his Law of Evolution, with additions, however, which introduce again new confusions of ideas of a lamentable, and at the same time, of a ludicrous character.

With the history of the subject, as well as with what I have to offer as the approximately correct expression of the Law of Development, I propose to deal in another work; the present paper is limited to the question whether the course of development in animals is really a progress from the homogeneous, so far as its very earliest steps immediately following the constitution of the new being are concerned.

It has always appeared to me the most serious difficulty in the way of granting the validity of such a law, that the impregnated egg in animals is really a highly complex bundle, which if not satisfactorily explained, must go far towards the rejection of the idea that the progress is from simple to complex. For if the progress of development be a gradual passage from the simple and homogeneous to the complex and heterogeneous, then the simplest and most purely homogeneous phasis of every animal's life, should be precisely this earliest one, immediately succeeding the union of the sexual elements, and which I shall call the *protembryo*, or protembryonic stage.

I was by these reflections, therefore, led to seek a satisfactory explanation of the apparently great and anomalous complexity and heterogeneity of the protembryonic stage, and the following provisional theory was the result of my inquiry.

The essential points of the theory here presented are the following.

1. That the whole egg is an amœba-like individual, in which the protoplasm of the yolk represents the ordinary protoplasmic mass of the amœba; the organic food-particles and granules represent the embedded food of Amœba; and the germinative vesicle with its contents represents the nucleus of an Infusorium or Protozoön.

2. That the spermatozoön likewise represents a protozoön, generally one of the Flagellata, and its nucleus the male element of the Protozoa. In the spermatozoa of the Nematoids we have Arcella-like forms; in the motionless spermatozoa of some Crustacea, forms which may be compared to Polycystina.

3. That the act of generation consists in an actual conjugation of at least two of those protozoöids (one ovum and one spermatozoön): but probably of a plurality of spermatozoa with one ovum in most cases.

4. That the result of this conjugation is twofold.

(A) A result of the combination of the nucleus of the spermatozoön with the germinative vesicle of the ovum; which result is the future animal. And

(B) The aggregation of the yolk-protoplasm, yolk-masses and granules with the protoplasm of the spermatozoa, all these together constituting a store of food for the immediate nourishment of the newly arisen animal.

5. That the newly found animal (A) is in all essential respects a Rhizopodal or Amœboid being, which at once proceeds under proper life-conditions to appropriate as food the provision (B) thus furnished it; and effects this in a manner essentially Rhizopodal; *i. e.*, by prolongations of its own substance enclosing in manifold ways, and part by part in smaller and smaller successive portions differing but little in size, the whole provision (B).

6. This appropriation of the whole provision (B) is the process called segmentation, and the equivalent processes seen for example in the eggs of insects and the higher crustacea. It is not necessary that it should be always a distinct segmentation, either total or partial, but it is necessary that it should be, under this theory, in all cases, a Rhizopod-like procedure.

7. In the conjugation, the weight of testimony from various observers, makes it probable that the germinative vesicle and the spermatozoon (or its nucleus) disappear and cease to exist as such. In their stead arises the new animal, or *protembryo*.

8. This may present itself under one of three forms.

a. A clear mass of protoplasm within the yolk mass — the embryonal vesicle of Wagner. *Entoprotembryo.*

b. A uniform, or nearly uniform layer of protoplasm, completely inclosing the yolk mass. *Ectoprotembryo.*

c. A combination of *a* and *b* — that is, the coexistence of a clear nuclear mass of protoplasm at the centre, with a distinct peripheral layer of protoplasm, the two being connected together by radial threads of protoplasm. *Pantoprotembryo.*

9. In the first case, *a*, the protembryo is supposed under this theory to appropriate the yolk by radial prolongations or pseudopodia extending themselves centrifugally towards the surface of the yolk.

In the second, *b*, the same end is assumed to be attained by the extension inwards of centripetal prolongations.

The third case, *c*, is probably only a further advanced stage of case *a*. The radial pseudopodial extensions already exist by hypothesis, and the yolk is included in their interspaces, which would correspond to the vacant interspaces in Noctiluca. At the surface they are united to a thin peripheral layer of protoplasm enveloping the whole.

10. In the second case, *b*, the utilization of the yolk is supposed to be effected gradually by the mechanical inclusion of small portions of it by inward extensions of the peripheral protembryo, so that the yolk is probably taken up, layer by layer, centripetally, as in Musca, Astacus, Limulus. In this case the blastoderm passes from the homogeneous simple protembryonic state to that of a cellular tissue, without presenting any such appearances as would be regarded segmentational.

11. In partial or meroblastic segmentation, the protembryo is, under this theory, supposed to surround the whole yolk, as in case *b*: either from its first formation; or by gradually extending itself over the yolk (during development) from a definite point, as an Amœba extends itself over a food particle of considerable size. In all partial segmentation, however, the protembryo is specially massed at a definite point, and is not simultaneously and uniformly extended *in equal thickness* over the whole yolk mass. The process, then, which leads to cellification here is limited at first to the point where the protembryo is massed. The gradual taking up of the yolk by inward sarcodic extensions is probably indicated by the formation of the so-called "formative cells" in the egg of the chick, and the supposed wandering of these cells by which they find their way into the middle layer of the blastoderm, is supposed under this theory to be due not to their own spontaneous movement, but to the movements of a hyaline and entirely diaphanous protoplasm, which is assumed to be part of the protembryo, and to fill the segmentation cavity. The free cells which lie beneath the blastoderm in the egg of the brook trout (Oellacher), are probably formed in the same way.

12. Wholly diaphanous protoplasm, devoid of granules, is frequently seen to extend itself in various forms outward from the peripheral contour of Amœba. There is no *a priori* reason why such protoplasm should not constitute part of the protembryo in the egg. The fact that it has not been observed, is not conclusive proof of its non-existence; for its extreme transparency and freedom from granules would render its detection, even when sought for, exceed-

ingly difficult, if not impossible, under the conditions of the earliest changes in the egg. It would almost uniformly present the appearance of mere spaces between the "cells" or "segment spheres," or between the yolk and the egg membranes.

It is supposed in this theory that such "Diaphane" as Carter proposed to call this simplest form of protoplasm, plays an important part in the early history of the embryo, constituting, perhaps, the most active part of the protoplasmic mass of the protembryo, enveloping and taking up portions of the yolk, so as to form "cells" or segment spheres, and also furnishing the common matrix in which these when formed are embedded; filling also the cavity of von Baer when present, and only gradually diminishing in quantity as the tissues beeome more perfectly formed.

13. The cases of total segmentation may be divided into those in which a nuclear "embryonal vesicle" exists, and those in which none has been observed.

14. The latter case seems to be exemplified in the eggs of *Geryonia hastata* as observed by Metschnikoff, where nuclei appear only after the first cleavage; and in those of *Idyia roseola*, where, according to A. Agassiz, none appeared until the formation of sixteen spheres, *i. e.*, the fourth cleavage. The case of *Eschscholtzia cordata* investigated by Kowalevsky, is particularly valuable on account of the care taken to determine the presence or absence of a nucleus by a very able observer, whose disposition was to believe in the persistence of the germinative vesicle in all cases. He could find none before the sixth cleavage, and then only in the small spheres which constitute the "Bildungsdotter," our *protembryo*. Moreover Kowalevsky observed in these eggs, as a preparatory phenomenon before segmentation, that the external protoplasm of the protembryo, "draws itself together and rolls by means of these contractions the inner yolk mass to one side or the other, in consequence of which contractions it finally heaps itself up upon one of the two sides." These movements are undoubtedly amœboid, and they lead directly to the process of segmentation of the enclosed yolk. The protembryo thus massed on one side puts out two prominent wart-like processes, between which forms a depression. This depression increasing and becoming a furrow, sinks gradually deeper and deeper towards the centre, passing through which it finally reaches the surface at the opposite side of the egg, which is thus divided into two segments. On each of these the outer layer, or protembryo, now so arranges

itself as to cover their surfaces of contact with only a very thin layer, while it masses itself on their free surfaces, and finally from the accumulations thus formed again sends centripetally inwards the division planes, which divide the first two segment spheres into four. Kowalevsky remarks that the transparency of the egg during these phases is remarkably favorable to the exhibition of a nucleus, if one existed, yet he could find none. The impulse producing the segmentation seems to proceed wholly from the outer layer of protoplasm (the ectoprotembryo); the inner or yolk responds to the motions, only as a seemingly dead and motionless body responds to mechanical pressure from without, possessing in itself no active intrinsic energy.

15. In these cases of segmentation with an ectoprotembryo, the theory here presented regards the segmentation as effected by the amœboid activity of its protoplasm operating from without inwards. There is obviously only a difference of degree and circumstance between the putting forth of pseudopodia (which in many Amœbæ are merely large lobes) and the inward extension of such plates of protoplasm as those here effecting the division of the yolk. When two lobe-like pseudopods are developed in any Amœba, an interval of emargination or depression is necessarily constituted between two pseudopodial lobes. If the lobes enlarge still further, they tend to engross the whole protoplasm of the animal, and to divide the food-mass contained in it between them. This is tantamount to an increase of the depression to a furrow, of the furrow to a cleavage plane; and a comparatively slight increase of such a furrow might in any case divide an Amœba into two. This actually happens when, as is sometimes witnessed, a large pseudopod actually detaches itself from the main body and becomes free.

16. In a large number of segmentational developments, however, the protembryo is massed *centrally*; thus constituting the "embryonal vesicle" or "nucleus" or "persistent germinative vesicle" of various writers. In these cases the segmentational influence seems to proceed from within outwards. The entoprotembryo being located at some point within the yolk mass, must indeed necessarily act centrifugally in possessing itself of the yolk. Under the provisional theory here explained, its mode of effecting this will still be amœboid; *i. e.*, the entoprotembryo will put out pseudopodia radially extending through the yolk mass towards the surface of the egg. As such pseudopodia are known to form net works and detached masses

of protoplasm in Rhizopods, the latter of which are probably capable of serving a digestive function, it is easy to conceive that in this state similar unions of the radial extensions of the entoprotembryo may finally traverse the yolk mass in every direction, and even unite in a thin uniform layer of protoplasm all over the periphery of the egg. In that case the entoprotembryo is converted into a pantoprotembryo, which indeed would naturally suggest itself as the type of which the other two forms in all cases are specializations.

17. In this case the process of segmentation is explained according to our theory as identical with the preceding, except that every segmentation is accompanied, as in Infusoria, by an elongation and division of the nucleus, or central massing of the protoplasm of the protembryo. If there exist any case in which segmentation occurs before the entoprotembryo has been converted into the pantoprotembryo (and such a case is quite conceivable), the energy of segmentation must of course there operate exclusively in a centrifugal manner.

18. The essence of the theory, therefore, consists in this—that the protembryo is conceived in all cases as an amœboid body of protoplasm which is prepotent over the protoplasm of the yolk, and under all circumstances of position in reference to the yolk, appropriates it as an Amœba appropriates its food; the process of segmentation being a modified form of such appropriation, by which the whole yolk mass is early divided into a great number of small particles, each contained and enveloped by a distinct cell-like portion (*sphæra segmentula*) of the protembryo. These cell-like portions of the protembryo are really, in the wide sense of the word, true cells, and subsequently by differentiation and multiplication become the cells of the mature organism.

19. The segment spheres (*sphæræ segmentulæ*) of the embryo, or blastoderm, are held together by some unknown agency, while appearing to be mechanically unconnected with each other. Moreover, when thus separated for a time (as when first formed), they approach each other again and then remain in contact, or are even pressed together with so much force as actually to be flattened one against the other, so that eventually after one or many subdivisions, they are converted by mutual compression from round to polygonal forms. In this condition they are variously disposed in different animals. In some they constitute a solid aggregation of spheres, in others a hollow spheroid whose cavity is known as that of von Baer. This cavity is usually regarded as empty, or at least containing no part of the

embryo; manifestly, however, for no other reason than that the transparent contents are of unknown nature. The phenomena, however, indicate the existence of an agency which controls the position of the segment spheres, which would not of themselves, merely as bits of protoplasm, become compressed together so as to have their form mechanically changed, nor arrange themselves in regular form as a blastoderm about a cavity, nor subsequently invaginate one part of this blastodermic shell within the other to form a "gastrula."

20. An agency capable of producing such special effects must be either an attractive and repulsive (*i. e.*, a selective or polar) force residing in the segment spheres themselves, as magnetism is supposed to reside in a magnet; or it is a protoplasm in which the segment spheres are embedded, as the "cells" of Actinophrys are embedded in the granular protoplasm which occupy their interspaces, and whose extensions constitute the radially arranged pseudopodia. Such a protoplasm would, however, differ from that of Actinophrys, in the fact that it must be entirely diaphanous and devoid of granules; identical, perhaps, with the clear protoplasm already alluded to (§ 12), and which Carter called *Diaphane.*

21. Under this theory the preference has been given to the latter hypothesis, as obviating the introduction of polar attractions between segment spheres, and necessitating only the assumption that in the appropriation of the yolk by the amœboid protembryo, while one portion of its protoplasm is specialized in the process of investing and cutting up the yolk into the small segment spheres, and so laying the basis of cellification, the remainder is retained in an unspecialized condition as a living and controlling matrix for the segment spheres thus formed.

22. If, therefore, the protembryo may be legitimately regarded as an amœba-like being, the blastodermic holoblast may be regarded as a stage of development analogous to Actinophrys; while under this theory all meroblasts are forms in which the protembryo first encloses the yolk, and the Actinophrys stage is inaugurated primarily only at one point whence in ever widening zones it gradually extends itself over the whole yolk, its extension being perhaps really no growth of the blastoderm, but a gradually extending conversion into blastoderm of the protembryo which already encloses the yolk.

23. During all these processes, the protembryo is of course supposed to be assimilating food and growing, so that its quantity

of protoplasm is largely increased, as in the case of the growth of Amœba. The blastoderm, on the other hand, also grows, both by the increase of its cells in number (by fission, etc.) and in actual bulk. Part of this increase, and in many cases the far greater part, as in the bird's egg, is no doubt due to the material assimilated from the yolk alone; but there are numerous examples among the lower marine embryos of growth, which can hardly be ascribed to this source only; and we must suppose that, like many protozoa, such protembryos also increase by the organic matter suspended or dissolved in the water; or that their protoplasm possesses also the vegetable power of building up inorganic matter into protoplasm. When in animals chlorophyl is present, we have a right to assume such a power, and certainly no definite line of demarcation can be drawn between animals and plants, either in generation or development.

24. According to the provisional theory just explained, Protozoa are organic forms in which the animal is its own sexual product, and they might on this account be called Oözoa, which would be a preferable name, as it does not prejudge the question as to the order of appearance of these animals in the sequence of life.

25. On the other hand, every egg and every spermatozoön may be regarded as an individual protozoön. In sponges Hæckel has figured the yolk protoplasm of the egg as putting forth pseudopodial lobes and behaving like an Amœba. In the spermatozoa of Ascarides, it has been long known that they not only resemble an Arcella in general form, but move also in a rhizopodous fashion. The egg of no animal is more motionless than an encysted protozoön; and, indeed, eggs provided with vitelline membrane only, or with this and other envelopes, may be regarded as encysted protozoa.

Again, spermatozoa under their ordinary forms may be regarded as flagellate protozoa.

26. The sexual maturity of a higher organism (Metazoön) then means its arrival at a stage of development when it produces unicellular protozoid buds (ova and spermatozoa), each of which is the vehicle of a sexual product — germinative vesicle or nucleus of spermatozoa.

27. Isolated, these sexual products are incapable of development; but they have a strong attraction for each other and unite with great energy, compelling as in Protozoa a conjugation of their protozoöid vesicles. They may therefore, and indeed must be, regarded as oppositely polarized protoplasms, whose combination results in an

undifferentiated and perfectly simple protoplasm capable of development, of which they themselves are incapable.

28. So numerous are the examples of parthenogenesis among Insects and Crustacea (Entomostraca, Rotifera), that some explanation of it seems necessary, even under a provisional theory. It is probable that this anandrous mode of production has many various, and perhaps totally different conditions at one time from what it has at another. I have not therefore attempted to give more than a suggestion here, which, nevertheless, I think contains an element that cannot be reasonably excluded as an impossibility in any case. The suggestion is that

29. In parthenogenesis the germinative vesicle takes no share in the formation of the new individual, which is strictly a development of the protoplasm of the yolk, which may be regarded as a bud from the maternal ovary. The egg of the queen bee, for example, may be regarded as a bud from the ovary. If the germinative vesicle receive the influence of the spermatozoa, a new being arises prepotent in development over the bud. But if not, the hypothesis is that the bud or yolk-protoplasm, may itself develop into a new creature, which in this case will be a drone. In many other insects the same bud will produce a female.

The provisional theory here explained was framed long before I was acquainted with the observations of Butschli, Fol and Oscar Hertwig upon the early changes of the egg preparatory to, and consequent upon, impregnation. It was designed and used as a means of temporarily grouping together the facts hitherto known in accordance with the conception of development by specialization, and as a stimulus to further thought and research upon this subject among the students to whom I was called upon to lecture. From them it has found its way to Mr. Minot, who sought and obtained from me some account of it in private conversations referred to by him.

It has not been possible for me, up to the present time, to make a close examination of the observations referred to (those of Auerbach I have not yet seen), and it is therefore impossible for me to enter as I should much like to do upon a critical review of the present state of our knowledge on this important subject. I have, however, been myself surprised at the harmony between some of the conceptions to which I was led by a general induction from the previously known facts, and the phænomena as actually observed. Thus the germinative vesicle, according to Butschli, spreads itself over the surface of the yolk and thus forms a thin stratum enveloping the protoplasm of the yolk. It seems to me that the observation of Hertwig should be interpreted in the same way, though he prefers the notion that the material of this vesicle is finally absorbed by the yolk; meaning, I presume, by absorption, assimilation, which would involve the complete withdrawal of the germinative vesicle from all participation in the constitution of the new animal or protembryo. Butschli indeed suggests a mixing of the matter of the germinative vesicle with the superficial protoplasm of the yolk; but he gives an alternative which is more consistent with our provisional theory when he speaks of it as possibly an "indistinguishable on- and inlaying" of these protoplasms together. Besides, Butschli regards the nucleus of segmentation as formed out of the earlier material of the germinative vesicle, a portion of which forms a prolongation penetrating inwards into the yolk which surrounds it. This portion, then, according to his view, becomes detached from the superficial protoplasm of the germinative vesicle and forms the nucleus; which, subsequently, is integrated with that other problematic body, regarded by Auerbach and Butschli as a second nucleus, and by Hertwig as a probable spermatozoön head or nucleus. Butschli seems to suppose the spermatozoön to be arrested at the surface, and then to be united with the peripherally disposed germinative vesicle, from which subsequently two or more nuclei are formed, and then uniting, compose the first nucleus of segmentation. But Hertwig's observation in one case of a linear appendage to this penetrating body, gives a great air of probability to his interpretation of it as a spermatozoön, or part of a spermatozoön.

If the peripheral disposition of the protoplasm of the germinal vesicle essentially corresponds with the conception of my ectoprotembryo, the radial extensions from the nucleus, observed by all these embryologists, seem to be identical with the radial pseudoped-like extensions assumed in this theory as put forth by the entoprotembryo. There is, however, nothing yet observed corresponding to the inwardly directed pseudopodial extensions which the theory assumes to be the agency by which the ectoprotembryo appropriates the yolk. We can hardly doubt, however, that in the case of many insects and crustacea, there is an actual ectoprotembryonic disposition of the germ, and consequently an appropriation of the yolk from without, such as I have sought to explain by inwardly directed protoplasmic processes of a temporary character.

On the other hand, and in contrast to these correspondences, there certainly exists an apparently irreconcilable difference between the observations of Hertwig and my provisional theory as to the agency of segmentation. The preference I had given to the view that the cutting up of the yolk, or its appropriation by fragments, is due to the ordinary spontaneous mobility of protoplasm, insinuating its extensions between the particles of yolk, and investing and removing portions of it, discarding at the same time the notion of an attraction, while I explained the appropriation of the segment spheres, and their appression one against the other by the contraction of an unseen protoplasm enveloping them, seems to find no support from the observations of Hertwig, which actually display such phænomena as might legitimately be expected if the morula-forming agency were a polar force. It is indeed impossible to avoid being struck by the general resemblance between the arrangement of the lines of granules, as observed by Hertwig about the poles of the elongated nucleus in the changes preparatory to segmentation, and the "lines of force" along which the iron-filings arrange themselves about the poles of an elongate magnet. Moreover, the impression is not lessened by the conduct of the segmentation, for the plane of division between the two segments when it appears does so precisely in the diamagnetic or equatorial plane at right angles to the axis of the elongated nucleus here representing the magnet; and the surfaces of division everywhere become at right angles to the lines of granules, which represent the lines of force. Such phænomena might be regarded as indicating that the division takes place along the plane of weakest polar action; while in strict correlation with this explanation is the observation that the clear protoplasm masses itself about the two poles of the nucleus. The interpretation suggested is, that the granules follow the lines of weakest polar action, while the protoplasm arranges itself in those lines and places where the action is strongest.

The hypothesis of a polar force, too, is entirely consistent with the apparently causeless approximation and appression of the two segments one against the other, after their division is complete. For the two magnets resulting from the division of a single bar magnet, would of course attract each other and finally adhere together, if free to do so.

There seems therefore to be sufficient analogy of phænomena to make the exclusion of a selective polar force quite impossible in the present state of our knowledge.

It may be, however, that notwithstanding the apparent irreconcilability of the two hypothesis, there is no real incompatibility between them.

The course of development is always one of polarization, and we cannot deny it to be in a large sense a polar force; yet this view of its character is not inconsistent with the highest pneumatico-psychological interpretation of its processes — and consequently cannot be inconsistent with the ordinary conception which represents the various coördinated movements of an Amœba as acts of volition, either conscious or unconscious. I once watched the behaviour of an Amœba, which I shall call *A. ubiquifluens*, when it seemed to be hesitating between the choice of several different routes of travel across the field of the microscope. Several differently directed pseudopodial lobes were put out, apparently towards special surrounding objects, as if they were extemporized sense organs of unknown nature. It occurred to me that in the absence of special sense organs, the determining cause of the issue of these lobes might be an attractive influence exerted by the surrounding objects upon the protoplasm of the animal, which nevertheless might exercise a choice or selection between the various solicitations of different objects. This it seemed finally to do, when after an interval of indecisive repose, all the lobes but one would be withdrawn, and the whole body move rapidly in the direction of the persistent lobe, which of course would be that turned toward the selected object. The existence of such an impressibility of protoplasm in the amœboid condition by surrounding objects, would be nothing extraordinary when regarded as a sort of equally distributed sense common to every portion of the protoplasm, and the objects themselves would in this view be the sources of the proper stimuli of this sense. Similarly, the presence of a yolk to be assimilated may be conceived to evoke such a response from the protembryo as is practically identical with a polarization of its protoplasm.

We are, however, upon the threshold only of this great inquiry, and must await the progress of research.

The view suggested by Mr. Minot as to the significance of the expulsion of the Richtungsbläschen, is one which never occurred to me, and is worthy of serious consideration. We may hope that it will be tested by its originator in a series of investigations which cannot fail to be of very high interest, however they may result for his hypothesis.

I cannot, however, consent to the term "alternation of generation," and consequently cannot accept his representation of the view which constitutes so essential a part of my theory (viz., that the ovum and spermatozoön are really each a protozoön, or that protozoa are really all oözoa) as establishing an alternation of generations throughout the animal kingdom. Indeed there is no alternation of generations; for there is only one generation in which these protozoöid individuals conjugate and disappear, and all that results from this conjugation is but *one* generation. The only alternation there is, is an alternation of individuals or personæ, as Hæckel calls them. The consequences, however, are most important, for if, as I claim, the egg and the spermatozoön are each individual animals, then there is under Huxley's theory of zoöids not a single persona in the whole animal kingdom, man included. This seems to me a complete *reductio ad absurdum* of the zoöid theory.

It must be confessed that the term persona, or person, as applied to very lowly organisms, cannot but be harsh to our English ears because we individually associate with the conception of personality an actual, or at least a suspended consciousness; and we are really without any proof of the existence of consciousness in the animals below man. I have therefore thought of the Greek δεμας, a body, somebody, as furnishing a less objectionable term. We may call all the various individuals making up a generation *demats*, a word which involves the notion of personality indeed, but does so with special reference to the body without reference to psychological relations, such as "person" has attracted to itself in English.

Again, if the view proposed by Mr. Minot be the true one, the explanation of Parthenogenesis suggested above will probably be superseded by his, which is that every egg contains not only the female but the male element of generation, even before the reception of the spermatozoön, and that when the latter is not received there may occur a self-fertilization of the egg; *i. e.*, a parthenogenesis; whereas, if the spermatozoön be received, it will prove itself prepotent, and the proper male element of the egg will be expelled in the form of Richtungsbläschen. No one will be better pleased than myself to see an explanation apparently so satisfactory established by the progress of research.

Whatever may be the issue on the minor points, it seems to me that one thing is established — I mean the entirely simple character of the protembryo. There can hardly be drawn from the observations made any other conclusion than that the protembryo is a small mass of undifferentiated and homogeneous protoplasm; in short, an amœboid protozoön, which in due course possesses itself of the whole yolk mass as food. To speak more particularly, observing the difference introduced by Hæckel between Amœba and the non-nucleated forms which he has called Monera, the protembryo is, strictly speaking, a Monera, specially conditioned for the development of that organic form from which it originated. How little such a Monera may possibly differ from those which are found free in nature, we conceive, upon reflecting that the complete life history of no Monera or Amœba is really known, and it remains to be determined whether they are not all protembryonic stages of higher organisms, either animal or vegetable. The history of Myxomycetes, alone, shows how directly an amœboid form may pass into a distinctly vegetable structure.

Again, it seems to me that my interpretation of the ovum and of the spermatozoön as protozoan demats is not likely to be invalidated; and I cannot but regard all protozoa as, strictly speaking, oözoa, or animal forms in which the individual, or demat, is the sexual product.

Prof. McCrady also read a paper on the "Diencephalic Canal" of Vertebrates.

A second valuable gift of books from the Hon. George B. Emerson was announced, and a vote of thanks to the donor passed.

A nearly complete set of the publications of the Novara Expedition, presented by the "K. K. Ministerium für Cultur und Unterricht" of Austria was also exhibited.

Annual Meeting. May 2, 1877.

The President, Mr. T. T. Bouvé, in the chair. Twenty-six persons present.

The following reports were presented by the Custodian, Secretary, and Treasurer: —

Report of Prof. Hyatt, Custodian.

The official year has been characterized by no event of great importance, except the changes made in the By-Laws with regard to the admission of women to the privileges of the Society, and the division of Members into two classes. These changes, however, have already been fully recorded in the Proceedings of the Society, and the time which has elapsed since they went into operation has been too short to enable us to draw any conclusion as to their general effect.

An additional room has been fitted up, with the new style of brackets and cases, for the reception, especially, of the birds and mammals of the Systematic Collection. An important improvement has also been made by the establishment of telegraphic connection with the Fire Engine House on Dartmouth Street, so that in case of fire we can ring a bell in that building, and have the engines here within a few minutes after the alarm.

teachers' school of science.

This has been continued, as in previous years, by the liberality of Mr. Cummings. The course was given by Prof. Goodale, of Harvard College, and comprised twenty-one lessons in morphological, physiological and systematic Botany.

Each lesson was, as usual, illustrated by specimens, which were distributed to the pupils. The analysis of the flowers and the determination of the peculiarities of floral structure were considered by Prof. Goodale a very important part of the course. For this purpose blank forms were distributed to the teachers, which enabled each teacher to pursue his examination of the flower in hand independently, prevented confusion, and enabled the instructor to cover more ground than would have been possible by any other method.

The attendance was unusually large, averaging one hundred.

LABORATORY.

The work in the Laboratory has been steadily progressing under the charge of Mr. Crosby. The collections for the use of students are being rapidly built up, and will, it is hoped, be completed during the next official year. The room and collections have been used this year by the Institute of Technology, not only for the instruction of the usual class, but also for the benefit of a class from the Boston University.

CONDITION OF THE COLLECTIONS.

The Minerals are in the same good condition as when last reported upon, but have received some very valuable additions through the generosity of the President, Mr. Bouvé.

The arrangement of the Geological Collection has been completed by the same gentleman, and is now open to the public.

Mr. Crosby's report shows that excellent progress has been made in the Paleontological collections, which are under his charge. All the fossils of the Triassic and the Cretaceous periods, and the larger part of the Jurassic formations in the European Department, have been mounted, catalogued, and labelled by Miss Carter, and are now on exhibition.

The work on the North American collection has been done by Miss Washburn, and has consisted in the rearrangment, cataloguing, and relabeling of all the fossils of the formations, from the Devonian to the Cretaceous, inclusive. The work in the Paleontological Department also included the identification of the new additions to the collections, which are very numerous. The Jurassic, Triassic and Carboniferous plants of North America have been tripled in number and value by accessions from the Rogers' Collection, and the Devonian and Cretaceous fossils rendered much larger and more complete by additions of a more general character, from the Hale and Cleveland Collections.

The Botanical Department, under the charge of Mr. Cummings, has been steadily progressing, as in former years. The revision of the General Collection is in progress, and about one-fourth of the whole has been completed by Miss Carter, the assistant in this Department.

Mr. Van Vleck has had the care of the Zoological Collections, and has also been specially engaged in rearranging and labeling the Anatomical Collection. The labor upon this Department has been much greater than was anticipated, and the completion of it has been on that account temporarily delayed.

The catalogue of the Microscopical Collection was finished by Miss Washburn, early in June, 1876. This collection consists, as far as it is catalogued, of 2606 slides and preparations; 567 of these are preparations of parasitic insects, acquired by purchase from the Burnett estate; 1838 slides were presented in the bequest of Prof. Bailey, consisting mainly of oceanic soundings, and specimens of mud and marl containing foraminiferæ and diatoms; 135 slides are miscellaneous preparations of worms, crustacea and embryos of various kinds, prepared by J. H. Emerton, when assistant in the Museum; and 113 are preparations of the anatomy and skeletons of sponges prepared by Mr. Crosby and the Custodian.

There are also some slides of a miscellaneous character, presented by E. Samuels, C. S. Busch, and others.

The unmounted material is represented by 273 samples of marls, etc., from the Rogers' Collection; and the duplicate material from the Bailey Collection, which is separately catalogued, is considerable. All the slides of the Bailey Collection, which contained several species of Foraminiferæ or Diatomaceæ, and which had been identified by Prof. Bailey himself, are entered in a separate book, entitled "The Catalogue of the Bailey Microscopical Slides." These slides are registered under the same numbers as in the current catalogue, but instead of only one line devoted to a general description and name of the locality, the space of half a page or more is devoted to the list of the species found upon that particular slide, together with the marks and measurements for finding each specimen. Prof. Bailey had begun this catalogue by registering 793 slides in this manner on foolscap paper, and this was continued by Miss Washburn. 1391 slides were entered in a similar manner by this lady upon loose sheets of foolscap paper. The original notes of Prof. Bailey, contained upon slips of paper usually loosely wrapped around the slide, were faithfully transcribed, and the originals filed away for preservation. The whole, amounting to 372 sheets of foolscap, has been substantially bound, and is now available for reference.

The microscopical collections have also been greatly enriched during the past year by a collection of 477 slides, prepared by the late Wm. Glen, formerly Preparator at the Museum of Comparative Zoology, Cambridge. These were purchased and given to the Society by Mr. R. C. Greenleaf and Dr. A. D. Sinclair. The Society owes its thanks to these gentlemen, not only for the value of the gift, but for the admirable condition in which the slides had been preserved, and the substantially bound catalogue prepared by Mr. Greenleaf.

The Glen Collection is especially rich in sections of the spines of Echini and the tongues of Mollusks, and also contains a large number of miscellaneous preparations.

Including this accession, the Society's collection contains, exclusive of the duplicate material already picked out, 3356 slides and preparations.

The collections of Corals and Echinoderms are now being revised and prepared for labelling with printed labels by Mr. Van Vleck, and a similar work is being done by the Custodian for the Poriferæ.

Dr. W. K. Brooks continued his work in the Molluscan Department upon the models of the animals, which I particularly described in my last report, and succeeded in completing in all fourteen models, twenty-seven anatomical preparations and nine explanatory outline drawings. Dr. Brooks also completed the rearrangement of the shells now in the Museum, according to the plan so often described in these reports. The distribution and arrangement of the alcoholic collection was also begun, but could not be completed for want of bottles.

In October, Dr. Brooks, who had proved himself, by these and other works, a most valuable and desirable assistant, removed to Baltimore, having been appointed Assistant Professor in the Johns Hopkins University. The work upon this Department was continued under the charge of Mr. Van Vleck, who reports that about one-third of the collection on exhibition has been relabeled by Miss Washburn, with printed labels. Dr. P. P. Carpenter of Montreal, has continued the work of identification, and has completed a large proportion of the terrestrial shells.

The Articulata have all been rearranged by Mr. Henshaw, and the same gentleman, who has had charge of the Insects, reports that the New England Collection of Coleoptera has been completed, and the Neuroptera, Orthoptera, Hymenoptera, and Lepidoptera rearranged. Very important additions to the collection of Coleoptera have been made from the collection of the late Mr. Sprague, who will be remembered as an able assistant and earnest worker in our Museum. We have been permitted, in accordance with the verbal request of its late owner, to select therefrom every specimen of value to our collection. These additions, amounting to 600 species and 2000 specimens, and late advances in knowledge in this Department, have made it necessary to revise the entire New England collection of Insects. So far as arranged, it now consists of

	In Coll.	Known N. E. Species.
Hymenoptera	157	618
Lepidoptera	711	871
Coleoptera	1810	2211
Orthoptera	59	85
Neuroptera	65	135
	2802	3920

We are indebted to Dr. Hagen for the revision and identification of all the Neuroptera, and to Mr. Burgess for a similar service in the Diptera of the Harris Collection. The Society will be pleased to learn, that the entire Harris Collection, with the exception of the Coleoptera, has been transferred to the new style of boxes, and is safe from the ravages of Anthreni.

The biological collection has been partially rearranged, the alcoholic material sorted, and a systematic collection of Coleoptera partially formed by selecting the types of the different genera. The Society is indebted to Mr. Henshaw for voluntary professional labor upon this Department, amounting to about seven hours daily for the entire official year, and it is to be deeply regretted that we are not able to reciprocate the substantial character of these services.

The alcoholic collection of Reptiles has been sent to the Museum of Comparitive Zoology, in charge of Mr. Garman. This gentleman has kindly offered to name them, and under the instruction of the Director, Mr. Alexander Agassiz, will also add such species from their duplicates as are needed in our collection. Mr. Garman has also been instrumental in increasing our collection of fishes in the same manner with selected species, and the Society has reciprocated with other exchanges. Various departments in the New England Zoological Collections have been worked over by Mr. Van Vleck, the accessions incorporated with the old collections, duplicates picked out, and a large number of labels written.

We have now a New England Collection in every Department. That in the Paleontological Department was completed this year by Mr. Crosby, and one in the Geological Department can be picked out at any time by the same assistant, from material at present stored in our Laboratory.

We now need a new gallery around our Main Hall, which should be devoted to the New England Department, and contain all of these scattered collections, so that a visitor or student could see the whole range of the natural products of New England arranged in one continuous series.

The Custodian spent the past summer at Eastport, on the coast of Maine, and succeeded, with some assistance from Mr. Van Vleck, in adding considerably to the New England Collection, though this is now in such a state of advancement that we require in most Departments only the rarer species. Mr. Van Vleck and the Custodian have been materially assisted by Mr. E. G. Gardiner, who has continued to give voluntary assistance in the Museum.

The Ornithological Collection remains as usual, but it is hoped that a revival is about to take place in this Department.

Report of Mr. Burgess, Secretary.

In accordance with the new provision of the Society's By-Laws, I beg to offer the following report on the condition of the departments under the Secretary's charge.

LIBRARY.

The additions to the Library during the past year, though somewhat less in number than those of the preceding, have been perhaps more valuable. Among the most important accessions must be mentioned a large and valuable series of books, chiefly botanical, and containing many rare volumes, from Hon. G. B. Emerson. A nearly complete set of the publications of the Novara Expedition, presented by the Royal Austrian "Ministerium für Cultus und Unterricht," has also been received. The Lloyd Republican Institution has deposited a number of recent popular and general works on Natural Science on our shelves, a welcome addition.

Exchanges have been opened with twelve new Societies or Journals, *viz.*:

Société Belge de Microscopie	Bruxelles.
Magyar Nemzeti Múzeum	Budapest.
Kön. Ungarische Geologische Anstalt	"
Natural History Society of Glasgow	Glasgow.
Novénytani Lapok (Hungarian Journal of Botany)	Kolozsoár.
Commissao central permanente de Geographia	Lisboa.
Sociedad Geográfica de Madrid	Madrid.
Popular Science Monthly	New York.
Société Zoologique de France	Paris.
Società Italiana delle Scienze (detta dei XL)	Roma
R. Accademia dei Lincei	"
Royal Society of New South Wales	Sydney.

The classification of the additions of the year is as follows:

	8°.	4°.	Fol..	Total.
Volumes	258	71	28	357
Parts	740	227	10	977
Pamphlets	161	25	2	188
Maps, Charts and Photographs				98
			Accessions	1620

Nothing has been done in the way of binding, while of course the need of the work is constantly increasing. An appropriation for this purpose is earnestly desired.

The use of the Library seems regularly increasing. During the year 1019 books have been borrowed by 119 persons.

PUBLICATIONS.

The amount of matter published has been considerably less than during previous years. Two parts, concluding Vol. XVIII of the Proceedings have been issued, and the first part of Vol. XIX is in press. In the Memoirs, the second part of Prof. Hyatt's "Revision of North American Poriferæ" is in press, and will be published during the month.

MEETINGS.

The attendance at the general meetings has been good, and the interest of the communications presented well sustained. The meetings of the Section of Microscopy, whose place has been taken by the new Boston Microscopical Society, have been given up. The Section of Entomology holds its meetings as usual, with a small but regular attendance.

Since the last Annual Meeting a new Section, devoted to Botany, has been formed, holding bi-monthly meetings which, on the whole, have been fairly attended.

During the year four Corresponding Members, six Resident, under the old Constitution, and twenty-five Associate Members under the new, have been elected.

LOWELL LECTURES.

Five courses of free Lectures, supported by John A. Lowell, Esq., trustee of the Lowell Institute, have been given during the season, viz.: six on Comparative Embryology, by Mr. Charles S. Minot; four on North American Archæology and Ethnology, by Mr. F. W. Putnam; three by Major J. W. Powell, on the Cañons of the Colorado, Indian Life in the Rocky Mts., and Indian Mythology; six by Prof. N. S. Shaler, on the Geological Problems of Boston and Vicinity, and, lastly, five by Mr. S. H. Scudder, on the Organization and Metamorphoses of Butterflies. The courses seem to have been unusually interesting and well attended. Major Powell's Lectures had the largest attendance, averaging about two hundred.

Report of Mr. Scudder, Treasurer.

ANNUAL STATEMENT OF RECEIPTS AND EXPENDITURES, MAY 1877, BOSTON SOCIETY OF NATURAL HISTORY.

May 1, 1876, to May 1, 1877.

Admission Fees	$175.00
Annual Assessments	1385.00
Dividends and Income	3750.00
Walker Fund and Walker Prize Fund Income.	2866.30
" Grand Prize Fund Income	84.00
S. P. Pratt Fund Income	808.00
Courtis Fund Income	442.00
H. F. Wolcott Fund Income	352.00
Bulfinch Street Estate Fund Income	1646.09
Entomological Fund Income	20.00
John Cummings, Donation	500.00
Lowell Institute Subsidy for Lectures	1200.00
Insurance	200.00
	$13,428.30

Excess of Receipts over Expenditures	$1081.12

Most of this must be reserved for Prize purposes in accordance with conditions of "Walker Bequest."

Income from "General Fund," and other Funds applicable to General purposes, omitting the "Walker Prize," "Walker Grand Prize," "Pratt," "Wolcott," and Donations for Lectures	$8956.16
Expenditures for General Purposes.	8331.36
	$624.80

May 1, 1876, to May 1, 1877.

Library	$387.52
Cabinet	1972.52
Publications, above receipts from sales	882.36
Lectures	1711.98
Repairs of Building and Cases	703.58
Salaries	5421.00
Fuel	317.75
Gas	117.68
General Expenses	832.79
Balance	$1081.12
	$13,428.30

CHAS. W. SCUDDER,
Treasurer.

Boston, May 1, 1877.

We have to-day examined the accounts of Mr. Scudder, Treasurer of Boston Society of Natural History, and find them correct, and have given certificate to that effect.

R. C. GREENLEAF,
JOHN CUMMINGS.

The various reports were accepted, and the Society then proceeded to ballot for officers for the coming year. Messrs. Emerton and Minot being requested to collect and count the ballots, declared the following gentlemen elected for 1877–1878:—

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,
CHARLES W. SCUDDER.

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.

Samuel Wells,
R. C. Greenleaf,
B. Joy Jeffries, M.D.

Comparative Anatomy.

Thomas Dwight, 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.,
S. W. Garman.

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 candidates for membership were then elected:—

Honorary Members: Prof. Thomas Henry Huxley, Dr. Joseph D. Hooker, Mr. George Bentham, London; Prof. Dr. Albert von Kölliker, Würzburg.

Corresponding Members: Dr. W. K. Brooks, Baltimore; Dr. L. de Koninck, Brussels; Dr. Carl L. Zittel, Dr. W. Waagen, Munich; Prof. Albert Gaudry, Paris; Dr. H. J. Carter, London; Prof. Oscar Fraas, Stuttgart.

Associate Members: Mr. Edward Atkinson, Misses A. R. Curtis and H. E. Freeman, Messrs. Charles A. Houghton, H. D. Minot, John B. Sweet, Mr. and Mrs. Wm. H. Sawtelle.

The following paper was read:—

On the Pelvis and External Sexual Organs of Selachians, with especial references to the New Genera Potamotrygon and Disceus (*with Descriptions*).

By S. W. Garman.

In an endeavor to get at the significance, extent and limits of evolution, from physical causes or in consequence of selection, voluntary or enforced, it becomes necessary to study variation in forms, the structure of which renders them more susceptible to modification from changes in the influences which surround them,—forms which represent the more plastic stages of animals which at a later date acquire greater degrees of stability. Influenced by such an idea, a study of special organs in cartilaginous animals proceeds with constant question as to how a bony individual under similar conditions would be affected in its cartilaginous stages, or how the genus would have stood had its development been stopped before it attained the less impressible bony structure. An abstract of the facts noted during a study of this character is presented below. Attention is called to the comparative amount and character of variations in one or more organs among the genera of a well defined class that is without close resemblances to others which might be mistaken for genetic relations.

To prevent misapprehension, it may be well to state myself quite unable to adopt either "the theory of evolution as commonly accepted," or "the common idea of special creations." The theory of origin which has built itself in my studies, and which in the present state of my knowledge seems most reasonable and susceptible of proof, asserts (I) *that life began at different places and times*, (II) *that from commencements at different places and at various times series have developed which are now represented by groups of types of more or less resemblance*, (III) *that the earlier types were surrounded by less favorable and more simple conditions, and, in consequence, remained of lower grade, and* (IV) *that the conditions under which the last types have advanced necessitated rapidity of development, complexity of organization, and, consequently, the highest rank.*

As a theory it is a combination of evolution and what might answer for special creations, which requires less of proof for its establishment than the one, and less of abstract credulity for its belief than the other. Whatever started and developed a single series was competent to do all that is required by this theory. All the proof that has yet been advanced in support of evolution in any form supports it, and the "missing links" are in its favor.

Such a position makes it necessary, in the study of animal resemblances, that the student avoid mistaking for genetic affinities similarities which owe their origin and accumulation to physical conditions, and their perpetuation to heredity. It leaves one at liberty to believe, until it is proven otherwise, that such animals as Chimæra and the Shark had no common ancestor; or, on the other hand, that numerous species of what we now designate as genera had a common parentage.

As this communication is brought forward to place on record and secure certain things, rather than to publish entire the conclusions drawn or the generalizations reached, I shall confine myself, as far as may be, to statement, reserving special remarks upon affinities, causes, etc., until able to publish the drawings.

Throughout the class Selachia the pelvis is free from the balance of the skeleton. Its only connection with the vertebral column is ligamentary, by means of the muscles and their fasciæ. The upper (iliac) extremities end between or upon the layers of muscle near the middle of the side, in such as have round bodies. Attached to it are the ventral fins, bearing the claspers in the male, and the muscles required for their movement. Two very distinct types of this organ obtain in the class: one peculiar to the Chimæræ, the other common to the remaining orders, the Galeodes (Sharks) and the Batides (Skates and Rays).[1]

For propelling power the Chimæræ depend upon the pectorals and ventrals instead of the caudal, as the Galeodes, or the pectorals alone, as the Batides. This use of the ventrals, calling for great freedom of motion as well as support for large strong muscles, is accompanied by a form of pelvis quite different from that of either of the other orders. The pelvic girdle is in two portions, which are loosely joined by ligament in front of the vent. In each half what corresponds to ilium, ischium and pubis is a single broad cartilage with a stout tapering process (the ilium) from its outer posterior angle extending up the side of the body. Near this latter, on the hinder margin, is the articulation of the basal cartilage of the ventral, to which in turn is articulated the base of one of the penes. In front, on the pubic border in the males of Chimæra and Callorhynchus, there is a stout broad piece of cartilage which is so hinged as to fold backward into a concavity on the lower side of the pelvis, in which it rests covered by a band of muscle and the skin. There is a narrow longitudinal opening into this receptacle through which the cartilage is erected. On the inner margin and outer side of the latter there are sharp teeth-like hooks which enable it the better to serve its purpose as a holder in time of coupling. The only motion of which it is capable is outward and downward from, and back into, the cavity. A heavy longitudinal muscle rests on the upper side of the pelvic cartilage, having a tendon which passes over the rounded front margin and is attached to the outside or back of the holder. By this means the latter is thrown outward from its receptacle when in use. The male also bears a clubbed thumb-like holder on the forehead, between the eyes and snout. On the lower side of the ball this thumb is thickly set with strong sharp teeth, by means of which the pectoral fins of the female can be firmly held when caught between it and the head. When held in this manner the male has his snout under the fin, and is able to hold and turn the female, as is done by the male skates with the retractile hooks near the margins of the pectorals.[2] Having caught the female in this way, the difference in size between the sexes, the male being shorter, is seen to be just enough to bring the intromittent "claspers" into position when they are erected, turned forward and held by the pubic holders.

[1] Prof. L. Agassiz, Essay on Classification, 1857, p. 187.
[2] Garman, Proc. Bost. Nat. Hist. Soc. XVII, 1874, p. 172.

Callorhynchus has very complex pelvic holders. On the outer side of the broad primary of each there are blades which unfolded assume a fan shape. On the opposite or inner side each has a complicated, somewhat glandular sac, of which the mouth is closed by attempt to force its contents outward. The mouth being shut, the contained liquid is driven through a small cartilaginous tube, which connects with the sac and extends outward far enough to reach the groove of the penis, when it is turned forward, and through the latter the fluid is conveyed to the oviducts of the female. The position of the openings of the spermatic ducts and their distance from the grooves renders it difficult to see how the semen can be introduced into the oviducts without previous mixing with the water; but serious objection to this supposition vanishes on consideration of the methods practiced by Batrachians and Fishes, in which fertilization takes place only after both ova and sperm are thrown into the water.

Chimæra has a more simple form of holder. The articulation, position of receptacle, and the muscles by which it is thrown out are similar, but the organ itself is simply a broad rounded plate bearing on its inner edge a row of sharp hooks directed toward the base. It has neither the accessory plates nor the tubes, as in Callorhynchus. Necessity for the squirting apparatus is in great measure done away with, since the openings to the spermatic ducts are carried down to the prominence immediately behind the anus, and are thus directly under the grooves by which the liquid is conducted. The extremity of the tubes is surrounded by tissue which during the season of sexual congress becomes almost as rigid as cartilage. As the cavities in which the holders lie are under the bifid portions of the penes when in position they may also serve for throwing purposes, since a sudden contraction will send their contents between the parts or into the grooves, that the passage of the liquor might be made more certain.

The "claspers," really intromittent sexual organs, are articulated to the basal cartilage of the fin. They are differentiations from the fin itself.[1] The muscles for their erection and movement are quite as readily traced in this order as in either the sharks or skates.

Females, being without the holders, have much less development of the pubic portions of the pelvis than the males. In the position cor-

[1] See Prof. L. Agassiz, Proc. Bost. Soc., XIV, 1871, p. 339, for the uses and homologies of these organs. Compare with J. E. Gray, Cat. Shield Reptiles Brit. Mus., Pt. II., 1872, p. 30.

responding to that occupied by the clasper of the male, they have the rudiment of a similar organ, — a small cartilage articulated to the basal, a little anterior to and separate from the other cartilages of the fin. *The proper analogue of the clitoris of higher vertebrates is found in this rudiment.*

The pelvis of the species contained in the order Chimæræ is in two parts, very loosely joined by ligament. Each portion has, in the males, articulated to it the cartilage of one of the pubic holders.

The second order, Galeodes, shows an entirely different form of this organ. It is in a single piece, bears no indication of a symphysis, and has no other articulation than those of the ventrals in either sex. It may be described as a transverse bar or shaft of cartilage, placed across the belly immediately in advance of the vent. The ilium is generally continuous with the balance of the shaft, which from its shape and solidity offers little chance of distinguishing elements corresponding to those of the pelvis of higher animals. On the hinder side of each end of the shaft are the articulations of the anterior and basal cartilages of the fins.

The variations of the pelvis in shape and size are numerous in this order, and may be used to advantage in determining the genera. In great measure they can be correlated with the habits, and may be stated in general terms as follows: *an increase of strength, comparative bulk and straightness in proportion as the habits of a genus bring it more in contact with the sea bottom, and, conversely, an increase in slenderness and curvature with decrease in size as the dependence on the bottom is lessened.* The greater resistance encountered by the body and in the use of the ventrals, from the sands and impediments of the sea floor among those species making it their home, determine the greater size and strength of this organ.

A glance at typical genera selected from the order, as arranged by Messrs. Müller and Henle, is sufficient to show the extent to which reliance can be placed on the formula given above. Of the genus *Scyllium* the pelvis is straight (on the front margin) and strong; of *Carcharias* and *Zygæna* weak, depressed, and arched forward; of *Mustelus* and *Triakis* medium, not so much arched in front as Zygæna; of *Lamna* arched forward, much depressed and weak; of *Odontaspis* (the sand shark) like that of Scyllium, straight and strong; of *Alopias* depressed, short, arched forward and comparatively weak; of *Cestracion* (Port Jackson Shark) very stout, depressed, sharp edged in front and straight, or with a slight backward arch; of *Acanthias* strong, nearly or quite straight; and of *Squatina* moderately stout and curving backward.

Carcharias, Lamna and Alopias represent extremes in one direction, and Cestracion, Odontaspis and Scyllium, more at home near the bottom, are good representatives in the other.

None of the Galeodes have very prominent lateral or median prepelvic processes. The males, unlike those of the preceding order, have neither frontal nor pubic holders, and the forcing apparatus is even more simple than that of the skates; being here but a simple elongate muscular sac lying upon the muscles along the bases of the posterior rays of the ventral and by a duct connected directly with the groove of the penis. Where the male intromittent organs have an armature of shagreen or hooks it is so arranged as to facilitate introduction and resist withdrawal.

Though there is much greater variety of form in the order Batides, the plan, and the number and character of the articulations, remains as in the preceding. The shaft is without a symphysis in front of the vent as before, but in some cases it is so much arched backward that with the lateral prepelvic extensions the curve formed is a regular semicircle, and in others it is so much bent forward that with the spine-like median process it has the appearance of the furculum of a fowl. In some there are, in addition to the posterior iliac extensions, anterior developments from the ends of the shaft along the sides of the abdomen, and in others, instead of these lateral prepelvic processes, there is a median spine extending half or more of the distance to the shoulder girdle.

Differences of habits or of shape of body are usually accompanied by some difference of form in the pelvis, yet beyond these there are sometimes, in closely allied species, modifications of which the exact signification is not at all apparent.

Pristis, the Saw Fish, has a pelvis resembling those of the sharks; it is depressed, convex in front, and not very large or strong. After excepting this genus, which is somewhat similar to the shark in this portion of its anatomy, the order may be separated into two groups, one of which has the straight pelvis, or the backward curve, comprising the Rhinobatidæ, the Torpedinidæ, the Rajidæ, and a portion of the Trygonidæ, and another having the forward arch or furculum type, which marks the majority of the Trygonidæ, the Myliobatidæ and the Cephalopteræ.

The first group is that of the greatest diversity of habits, and, as is to be expected, contains the greatest variety of pelvic modifications. Through all of the second the ventrals seem to retain the same uses and about the same position, with respect to the axis of the body, consequently the variations in shape of the pelvis attending the different uses of these fins in the first group do not appear. Instead, it is such as are due to difference in the general build of the body that become prominent in this section. With the lines indicating the direction of use of the ventrals at right angles to that of the pectorals, and parallel to the vertebral axis in nearly or quite all of the species of the division, there are no apparent necessities for variation in the position of the articulations other than result from the changes of curvature of the shaft. In the first section the processes for articulations vary in position from the hinder side to the end of a shaft nearly straight as the fins are used more toward the side than backward. In the second they vary in position toward the end as the curvature of the shaft places the ends more directly backward.

The pelvis of *Rhinobatus* resembles that of Raja; it is nearly straight, strong, depressed, and has short stout processes from the ends on each side of the viscera.

Torpedo presents an extreme case of the backward arch, as well as of the side attachment of the ventrals. The cartilage extending forward on each side of the abdomen seems to be a direct continuation of the shaft (pubes and ischia), though, if we consider its beginning to be at the articulations, it corresponds to the ilium.

Narcine, of the same family, has a shaft more straight but still concave anteriorly; the ilium is represented by long slender forward extensions between the wall of the body and the abdominal cavity, and also by a similar extension posteriorly, — an iliac development in a measure resembling that of the bird.

Raja has a strong straight depressed shaft, with processes in front of each extremity. This form is common to the entire family. The greatest variation occurs in Sympterygia, and a peculiar type (*Malacorhina mira*, described below) from the Mejillones, of which but a single specimen has come to my notice.

Sympterygia (see *S. acuta* below) has a slight forward curve and long slender anterior iliac extensions, somewhat resembling those of Narcine. The specimen from the Mejillones, while agreeing with Sympterygia in respect to absence of rostral cartilage, bears in other respects a closer resemblance to Raja. It has a straight shaft, and lateral prepelvic cartilages intermediate in size between those of the two. Differentiation of the anterior portion of the ventral and its use as a sort of limb direct attention to the articulations at the end of the shaft.

Two quite different patterns are to be seen in the species of the Trygonidæ, one of which appears only among those frequenting the rivers of South America, and another common to all the marine species. The former may be designated as the subfamily *Potamotrygones*, the latter as that of the *Thalassotrygones* (characterized below). Differences of general structure and habits accompanying those of special interest in this communication give ample grounds for the separation.

One of the most peculiar pelves in the order is that of the river Trygons. Compared with the size of the body, the shaft is short. It is very strong and nearly straight. From the middle of its length a strong tapering cartilage extends more than half the distance to the shoulder girdle,— a peculiarity not shared by the marine species of the family. Schomburgk, to whom we are indebted for what we know of the habits of the South American trygons, gives a hint as to the probable utility of this subabdominal cartilage. Speaking of species of one of the two genera making up the division, he says "they dig round holes five or six inches in depth, in which they lie, sometimes partly covered with sand, in order easier to entrap their prey."

Since the soft flexible borders of the disk are wholly unfit for digging purposes, it follows that the ventral fins must be used in making the pits. And since the resistance to the fin is often considerable the necessity of more than ordinary steadiness of the pelvis becomes apparent. As the subabdominal process permits but a small amount of lateral motion, and can be controlled by the bands of muscle attached to the sides of its posterior half, it aids materially in securing the desired firmness. Its position upon the muscular wall of the abdomen effectually prevents anything like a rolling motion of the shaft.

But while one of the genera of Potamotrygons, *Potamotrygon*, is well fitted for the digging and for capturing the prey unwary enough to approach the pit, the other, *Disceus*, is constructed on a different plan. The first has a strong tail and a large caudal spine, which is situated at so great a distance from the body that its wearer can strike an animal on whatever portion of the disk it may happen to touch. *Disceus*, however, has a greater expanse of disk, a much weaker tail, and a small spine placed so close to the body that the radius of its circle of motion is so insignificant in comparison with the extent of dorsal surface that it is impossible that it should depend on capturing its prey by the same means as the former. The ventrals are attached backward, and have not the same freedom of motion for digging. The small eyes, the position of the mouth so near the centre of the ventral surface, and the extraordinary distribution of nerves under the forward half of the body, tend to confirm me in the belief that this genus finds its food by means of touch, on the lower side rather than the upper, and captures by pressing down with the enormous pectorals, when the struggles of the captive will help to bring it to the mouth. A shorter and weaker prepelvic cartilage is found in this genus.

Behind the spines the tails of older specimens of these genera become calcified to such an extent that the vertebræ are consolidated. Once rigid they are easily broken, and it is only young individuals that are found with the tail entire. The caudal spine is replaced by a new one which appears under and posterior to it. If not readily detached, as is often the case, the succeeding protected by the first attains its growth and is in many cases followed by another reaching a size still larger. Should the specimen be growing rapidly the hinder ones are carried back so that each is at a distance from the other. Where the growth is slow the spines are bunched together, the base of the later resting beneath and very little behind the preceding.

Anacanthus, of the Thalassotrygons, has a compressed pelvic shaft, arching forward and without spine or angle in front.

In *Trygon* the shaft is slightly depressed, and more or less regularly arched in front.

Tæniura and *Urolophus* have the lateral halves more straight and meeting in front in a very blunt angle.

Pteroplatea has still more of a furculum type.

Myliobatis, *Aëtobatis* and *Rhinoptera* possess a greater forward arch and the median angle is produced.

Cephaloptera presents the perfection of the furculum type, and the production of the angle in front bears a certain resemblance to the subabdominal cartilage of the Potamotrygon.

All of the species included in the *Thalassotrygones* the *Myliobatidæ* and the *Cephalopteræ* have the ventrals directed backward. Their principal uses would seem to be as rudders, to change the direction of the body in swimming, and in coupling.

Knowing from experience the desirability of descriptions of individuals of forms rare and difficult to secure, I have ventured to describe a couple of species from single specimens rather than hide the knowledge of their existence for years, it may be, in the hope of securing duplicates. For the description a zoologist will overlook the risk taken, and the mere compiler, who would denounce a synonym most loudly, is entitled to much less consideration. The descriptions and notes are taken from specimens in the Museum of Comparative Zoology at Cambridge.

Sympterygia acuta sp. nov.

Disk rhombic, longer than wide. Pectorals meeting in an acute angle at the end of the snout, with lateral and posterior angles rounded, bearing the indentation of the sinuous anterior margin about midway. When expanded, the ventrals have their posterior borders in the same lines as those of the pectorals; their anterior portions are separated by a shallow notch from the posterior, and the outer and hinder angles are acute. Tail depressed, quite thin toward the end, with a fold on each side, bearing two small rounded fins near the extremity. The back and tail and anterior halves of the pectorals are rough with small sharp scales, the points of which are directed inward and backward. A row of spines with broad bases and sharp hooked points extends from the shoulders along the middle of the back to the second dorsal. Ventral surface smooth. Eyes and spiracles small, about equal in size. Nasal valves as in Raja. Mouth arching forward. Teeth small, subquadrangular on the base, sharp in the middle series, blunter to flat toward the angles of the mouth, in forty-two series on the upper jaw and forty on the lower. Color reddish brown, darker on the dorsum and tail; white below.

Total length 13.5; length of disk, including ventrals 9; length of anterior borders of pectorals 5.8; posterior borders 6; and distance from the end of snout to mouth 2.7 inches.

Distinguished from *S. Bonapartii* M. et H. by the greater length of disk as compared with its width, the greater length of snout, the shorter tail and the shape of the ventrals. In *S. acuta* the ventrals are one-fourth longer from the anterior extremity of the base to the posterior angle than from the same point to the lateral angle; the longitudinal measurement is least in *S. Bonapartii*.

Specimen secured by the Hassler Expedition at Buenos Ayres.

Raja (Malacorhina) mira sp. nov.

Disk rhombic, resembling in shape that of *Raja erinacea*; anterior margins indented in the middle, lateral and posterior angles and the margin about the head broadly rounded. Without a rostral cartilage. In front of the nostrils the basal cartilages of the pectorals are strongly developed and extend to the extremities, thus compensating for the absence of the rostral. A narrow extension of the translucent tissue, anterior to the forehead, separates the pectorals, and is produced beyond them into an acute point. The lower side of this prolongation is dark colored and covered with small, sharp scales, differing in these respects from the remainder of the lower surface, which is white and smooth. Ventrals divided by a deep notch; anterior portion narrow, extending laterally twice the width of the hinder part, covered by the pectoral; posterior more than twice as long as wide, outer margin convex, angle acute. Inner ray of the ventral connected with the tail for a long distance backward by a broad fold of skin. Claspers long, subcylindrical, tapering from the base, pointed, each provided with two sharp sickle-shaped blades or hooks. The bases of the claspers are stout, and the posterior halves slender. Tail depressed, thick at the base, tapering regularly to the second dorsal, thence compressed to the end, with a fold on each side and a rayless terminal fin behind the second dorsal. Dorsals small, the portion of the base occupied by the rays very narrow, with rounded outlines, separated by an interspace with a spine. Eyes medium, prominent, equal in diameter to the spiracles. Eyelid as in Raja. Upper surface rough with very small spines; a patch of larger ones on the forward extremities of the pectorals. Several large compressed spines in front of each eye, above each spiracle, and on each shoulder. A median row of similar spines from back of head to dorsal, a lateral row on each side of this down the back, and one or more lateral rows on each side upon the tail. A band of erectile hooks on the pectorals of the male, as in Raja. The portion of the pectoral reaching forward from a point opposite the back of the head is quite narrow, and in each fin — alike on upper and lower surface — has the appearance of being separated from the balance. Nostrils distant from each other more than their distance from the circumference of the disk; with two valves, the anterior semicircular, expanded laterally, notched on the inner side, the posterior triangular, reaching the angle of the mouth. Teeth sharp in the central rows, blunter toward the sides, in thirty-seven rows in the upper jaw, forty-two in the lower. Anterior lateral processes of the pelvis slender, equal in length to their distance from the middle of the shaft.

Total length 14.6; from snout to extremity of ventral 9; from snout to tail 7.7; from snout to vent 6.6; from snout to mouth 1.7; and width of pectorals 9 inches.

Specimen from the Mejillones.

TRYGONIDÆ.

Pectoral fins continuous, united in front of the head. Skull not produced into a rostral cartilage. Tail slender, tapering. A serrated caudal spine present in most genera (absent in *Anacanthus*).

Dorsal fin absent or rudimentary.

With a subabdominal cartilage from the pelvis, inhabiting fresh or brackish waters . . . . POTAMOTRYGONES.

Without a prepelvic cartilage, marine, few species venturing into fresh waters . . . . THALASSOTRYGONES.

POTAMOTRYGONES.

Mouth without papillæ; teeth in less than twenty-five series in each band; caudal spine near the pectorals . . . . . . DISCEUS.

Mouth with papillæ; teeth in more than twenty-five rows; caudal spine distant from the pectorals . . . . POTAMOTRYGON.

Disceus gen. nov.

Disk oval. Head not prominent. Spiracles with a process on the posterior margin. Mouth near the centre of the disk. Tail slender. Caudal spine small, near the body. Peripheral vascular system anastomosing into a network on the anterior half of the lower side. Oral papillæ undeveloped. With scales and tubercles. Name from δισκεῦς, a meteor having the shape of a quoit.

Disceus strongylopterus.

Trygon aiereba Müll. & Henle, Plagiostomen, p. 196 (not 160).

Trygon strongylopterus Schomburgk, Fish. Brit. Guiana, II, p. 183, pl. 22.

Trygon strongylopterus Müll. u. Trosch., Schomb. Reisen, III, p. 642.

Trygon (Himantura) strongylopterus Dumeril, Elasmobranchs, p. 592.

Trygon (Paratrygon) aiereba Dum., l. c., p. 592.

Trygon strongylopterus Günth. Cat., VIII, p. 476.

Trygon orbicularis Günth., l. c., p. 482.

Disk oval, truncate or concave in front. Snout without a prominence. Head small, at the end of the anterior third of the disk. Eyes very small, far apart, the only portions of the head appearing above the level of the disk. Spiracle small, immediately behind the eye, with a large rounded cartilaginous process on its hinder margin. Nasal valves right angled, short, wide, confluent, attached in the middle, fringed on the posterior edge. Mouth small, regularly curved, without papillæ. Teeth small, subtriangular on the upper surface, anterior side convex, inner edges and angle sharp, in eighteen series on the upper jaw and seventeen on the lower. The bands of teeth do not extend more than half way from the middle to the angle of the mouth. Ventrals triangular, length equal the width when spread, not reaching the margin of the pectorals. Tail less than one and a half times the length of the disk, depressed in its entire length, with a serrated spine near the extremities of the pectoral fins. The short portion in front of the spine is stout, and is armed in the later stages with irregular rows of sharp pointed, broad based tubercles; the posterior portion is thread-like, and bears narrow membranous expansions above and below.

Young specimens without scales or tubercles, brownish yellow, with lines or spots of brown, white below. At this stage the spiracles are comparatively larger, and the portion of the disk in front of the eyes shorter, truncate, or slightly convex.

Medium sized yellowish brown, reticulated or spotted with brown, covered on the upper surface with small harsh scales, with irregularly placed long-pointed tubercles on the tail between the pectorals.

Large examples are brown, uniform or with blotches of darker, and have the margin in front of the head indented. On the lower side the skin becomes very tough and leathery with age. The scales bear a single cusp in the centre, and one on each of the three or more narrowly compressed blade-like rays.

Length of pectorals of medium sized specimen 12.3; from margin to eyes 3.9; and width of disk 11.8 inches.

Length of pectorals of young example 8.8; from margin to eyes 2.5; width of disk 7.7; tail from ventrals 13.1; and total length 21 inches.

The Museum contains specimens from Para, Manaos and Obidos, presented by the Thayer Expedition.

Potamotrygon gen. nov.

Disk oval, lengthening with age. Head rising little above the level of the body. No prominence on the side of the spiracle. Taie depressed anteriorly; posteriorly compressed into a sharp anglle above, and, becoming calcified, easily broken. Peripheral vascular system not forming a network on the ventral surface. Oral papillæ prominent. With asperities and tubercles.

Species that cannot be determined:

Aiereba Marcgrave, Pisc. Bras., 1648, p. 175.

" Jonston, De Pisc., 1649, Tab. 38, f. 6.

" Willoughby, Hist. Pisc., 1686, p. 68, Tab. C 1, f. 2.

Raja orbicularis Bl. Schn. Syst. Ichth., 1801, p. 361.

Trygon aiereba Müll. et Henle, Plagiost., 1841, p. 160 (not 196).

The specimens at hand furnish characters sufficient for the establishment of the species indicated by the following synopsis.

Body longer than wide, thick, marked with irregular lines of dark brown, which often form networks of polygons, or rounded spots, sometimes uniform. Teeth small . . . . *Humboldtii.*

Body nearly round, moderate, commonly marked with round spots of yellow or orange with dark brown borders, varying in color from light yellowish with numerous spots to uniform dark brown. Teeth larger . . , ... *motoro.*

Body nearly round, thin, marked above with brown lines or spots often uniform light brown. Adult with blotches of brown below. Teeth very small . . . . *Dumerilii.*

Potamotrygon Humboldtii.

Pastinaca Humboldtii Roulin, Ann. Sc. Nat., 1829, XVI, p. 104, pl. 3.

Trygon hystrix Müller & Henle, Plagiostomen, p. 167.

" " D'Orbigny, Voy. Amer. Merid., Poiss., pl. 15, 1847.

" " Schomburgk, Fish. Brit. Guiana, p. 180, pl. 20, 1852.

" " Castelnau, Anim. Amer. Sud, Poiss., p. 103, 1855.

Trygon (Tænura) Orbignyi Cast., l. c., p. 102, pl. 49, f. 1.

" *hystrix* Dumeril, Elasmobranchs, p. 608, 1865.

Tæniura Orbignyi Dum., l. c., p. 624.

" *Magdalenæ* Dum., l. c., p. 625.

" *Orbignyi* Günther, Cat. Fish. Brit. Mus., VIII, p. 484.

Trygon hystrix Günth., l. c., p. 482.

Disk oval, rounded in front, longer than broad, narrower in the posterior half. Body thicker than that of the other species. Head flattened, wider across the spiracles, not prominent above the disk. Snout with a small prominence. Eyes small, prominent. Spiracles large, immediately behind the eyes. Nasal valves confluent, attached in the middle, with rounded angles. Mouth small, curved, with five papillæ. Sinuation of upper jaws slight. Teeth equal, small, lozenge-shaped on the base, with a transverse ridge bearing three cusps in the young, becoming blunt and losing the lateral cusps in the older, varying in number of series according to age — from twenty-six to forty-eight in upper jaw. Ventrals triangular, with blunt extremities, hinder margin partially serrated. Tail stout, depressed, bearing a large serrated spine at a distance from the base of little less than half the length of the disk, slender posteriorly, compressed into a keel on the upper side, and bearing narrow cutaneous expansions above and below, terminating in a finless thread. The very young are naked, yellowish, with narrow lines of brown, which, if extended, would form a network.

Specimens two or three times the size of these are darker colored, with lines more distinct, and a median row of tubercles on the tail anterior to the caudal spine. Medium sized are brownish, the brown lines very dark, polygons indicated in the ground color, the centre of the disk and the top of the tail covered with asperities, and a row of tubercles on each side of the tail similar to those of the median series.

Large individuals are of a dark greyish, yellowish or olivaceous brown, with the lines indistinctly defined, the polygons appearing more like rounded spots of lighter color, the entire disk covered with small, harsh scales, the tail furnished with irregular intermediate rows of tubercles, the lateral rows continued on the compressed portion behind the spine, and the caudal keel prominent and very rigid. Transverse brown bands separated by white mark the tail at first; the latter are afterward bisected by narrow bands of brown and ultimately the white is broken into spots by its encroachments. Marks similar to those on the disk cover the ventrals and retain their distinctness after the body has become uniform. Lower surface whitish; older specimens acquire a brown margin that widens with age.

Fourteen specimens collected by the Thayer Expedition.

Potamotrygon motoro.

Tæniura motoro Müller & Henle, Plagiostomen, p. 197.

Trygon garrapa Müll. & Trosch., Schomb. Reisen, III, p. 642.

" " Schomburgk, Fish. Brit. Guiana, II, p. 182, pl. 21.

" (*Tænura*) *Mülleri* Castelnau, Anim. Nouv. Amer. Sud. Poiss., p. 102, pl. 48, f. 2.

Trygon (*Tænura*) *Henlei* Cast., l. c., p. 102, pl. 48, f. 3.

Tæniura Mülleri Dumeril, Elasmobranchs, p. 621.

" *Henlei* Dum., l. c., p. 623.

" *motoro* Dum., l. c., p. 624.

" " Günth., Cat. VIII, p. 484.

Disk oval, rounded in front, a little longer than wide. Head broader than that of Humboldtii. Eyes, spiracles and nasal valves, as in the preceding. Snout with a small prominence. Mouth larger, with a deep and wide indentation on the symphysis in the upper jaws, with five papillæ. Teeth much larger than in either of the other species of the genus, unequal, blunt; varying in number of series — from twenty-five to thirty-eight in the upper band — according to age. Adult specimens have two or more rows of large, flattened teeth in the middle of each band. Hinder extremities of pectorals rounded. Ventrals triangular, longer than wide, rounded at the extremities. Tail strong, depressed anteriorly, bearing a sharp dentated spine at a distance from the base equal to half the length of the disk; slender posteriorly, compressed into a sharp keel above, round below, with narrow cutaneous expansions on the top and beneath. Prepelvic cartilage reaching more than half-way to the shoulder girdle.

Young naked, brownish yellow on the dorsal surface, with three or more concentrically arranged series of spots of orange encircled with brown.

Medium sized covered with small harsh scales, a dorsal and two lateral rows of spines on the tail, darker brown with the spots distinct.

Large ones with the scales on the central portions of the disk larger and scattered; color varying in different specimens from brown with the spots well preserved, to brown with only a blotch of dark brown to mark where the spot has been, or to uniform dark brown.

Very large specimens have medium sized tubercles near the margin of the disk.

The claspers are short, subcylindrical, jointed in the middle of the length. The scales are stellate; each ray is compressed very thin and serrated on the edge.

In shape and thickness of disk this species is intermediate between Humboldtii and Dumerilii; it is readily distinguished from either by the teeth, which are much larger and differently shaped.

Twenty-nine specimens from various localities.

Potamotrygon Dumerilii.

Ellipesurus spinicauda Schomburgk, Fish. Brit. Guiana, II, p. 184, pl. XXIII.

Trygon (Tœnura) Dumerilii Castelnau, Anim. Amer. Sud, Poiss., p. 101, pl. 48, f. 1.

Ellipesurus spinicauda Dumeril, Elasmobranchs, p. 582.

Tœniura Dumerilii Dum., l. c., p. 622.

Ellipesurus spinicauda Günther Cat., VIII, p. 472.

Disk subcircular, nearly as broad as long, retaining its width posteriorly. Head broad, flattened. Snout with a prominence. Eyes small, prominent. Spiracles large, immediately behind the eyes. Mouth curved, indentation in the upper jaw shallow, with five papillæ. Teeth equal, very small, the inner edge prominent and bearing three cusps, upper surface concave, bases pentagonal, with the outer angles rounded and the outer side concave, in twenty-six to forty-four series — according to age — in the upper band. Posterior angles of pectorals rounded. Ventrals triangular, with rounded extremities. Tail broad, depressed, with a serrated spine at a distance from the ventrals equal to more than half the length of the body; slender posteriorly, compressed into a keel on its upper half, lower half round, with narrow cutaneous expansions above and below.

Young naked, yellowish, with brown lines or spots, light colored on lower surface.

Medium sized brownish, with rounded spots of light color, covered with small sharp scales on the back, with a dorsal and two lateral rows of spines on the tail.

Large examples brown, spots nearly or quite obsolete, entirely covered on the dorsal surface with scales, with very large swollen-based sharp-pointed tubercles of irregular sizes and shapes on each shoulder, in the median and lateral rows on the tail, and in a band around the disk near the margin.

On specimens before me some of the tubercles are more than an inch in diameter and bear from one to half a dozen points; some of the caudal tubercles measure three quarters of an inch in length of base and in height.

The brown color predominates on the ventral surfaces of the old ones, the white remains in irregular patches near the centre; the bands which mark the sides of the tails of the young are lost.

This species is readily distinguished from Humboldtii by the roundness and thinness of the disk and by the tubercles. It differs from motoro in teeth and markings.

Fourteen specimens from the Thayer Expedition.

Ellipesurus spinicauda of Schomburgk is probably a mutilated specimen of one of the varieties of this species. The shape and thinness of the body and the coloration favor this conclusion. The length given by the author includes that of the tail; if this be subtracted, the length and width of the disk must be nearly equal. "Like others of the species, they dig holes in the sand, in which they lie flat, and there await their prey." This being the case, it would be difficult to imagine how the creature makes its captures without the spine.

Under each species of the genus there are one or more varieties. Specimens of the same species from different rivers of the South American system present marked differences. If the river faunæ were completely isolated, one could hardly hesitate in pronouncing the distinctions specific. Connected as they are, the intermediate forms are so numerous and the transitions so gradual that the characters seized upon in specimens from a particular locality are soon lost without having served for purposes of limitation or definition.

The possession of such local characteristics in representatives of a species from different rivers, as the Madeira, Tapajos and Araguay, suggests a comparative absence of migration. It may be that the greatest changes of locality are those called for by shrinkage in the water area during the dry season.

A more comprehensive knowledge of the movements and habits of the fresh water fishes of South America is a matter of the utmost importance to Zoology. The results to be attained by a Brazilian Fish Commission would form a princely gift to science. Possibly we may have these results without the long delay and laborious collation of isolated facts attending the growth of Ichthyology elsewhere. Science has good reason for hope in the friendship of such a ruler as His Majesty, the Imperial Philosopher, Dom Pedro II, Emperor of the Brazils, to whose friendly interest the Museum is greatly indebted for the collections from which these notes have been taken.

Dr. B. Joy Jeffries made some remarks in continuation of his recent communication on color blindness, describing a new test for the discovery of this defect.

Section of Botany. May 9, 1877.

Mr. R. W. Greenleaf in the chair. Eighteen persons present.

Mr. Greenleaf described the structure of the Violet for the prevention of self fertilization.

Mr. W. P. Wilson showed some forked willow-catkins. He also made some remarks on the germination of Megarhiza, a plant remarkable for the extraordinary length of its cotyledonary petioles.

The following paper was read: —

Notes upon Vernation. By Byron D. Halsted.

The leaves of the common lilac (*Syringa vulgaris*) are arranged in decussating pairs; and in the bud each pair encloses all those that are younger — so that the question of vernation is simply the relation of the leaves of any pair to each other. This relation is either one of *convolute* or *imbricate* vernation, and always very decidedly one or the other.

In the following examinations, branches were taken from various shrubs, and six pairs of leaves noted in each of six buds of each branch.

The buds were examined beginning at the lower end of the branch; and of course the pairs in each bud in the order of their development. The accompanying diagram represents the vernation of the leaves in the six buds of one branch, which was numbered seven; the figures in the side column give the number of the bud, while the upper row of figures designates the number of the pair in each bud. Each letter thus represents a pair of leaves, and where they are convolute the letter *c* is placed, while *i* is used when imbrication is found.

Branch No. 7.

	1	2	3	4	5	6
1	*c*	*i*	*i*	*c*	*c*	*c*
2	*i*	*c*	*c*	*c*	*i*	*c*
2	*c*	*i*	*c*	*c*	*i*	*c*
4	*c*	*c*	*i*	*c*	*c*	*i*
5	*c*	*c*	*i*	*c*	*c*	*c*
6	*i*	*c*	*c*	*c*	*c*	*i*

Thus in the first, or lowest bud of branch 7 we find the 1st, 4th, 5th and 6th pair of leaves convolute, and the 2d and 3d imbricate, in the bud. In this branch, out of the 36 pairs of leaves, 25 are convolute and 11 imbricated.

The next table represents simply the results obtained in examining 13 branches in this fashion — the number of the branch being given at the left, followed by a number of convolute pairs in the second column, and those that were imbricated in the third.

No.	*c*	*i*
1	22	14
2	30	6
3	35	1
4	22	14
5	27	9
6	27	9
7	25	11
8	28	8
9	27	9
10	24	12
11	21	15
12	36	0
13	21	15
Total	345	123

This gives the number of convolute to imbricated buds as in the ratio of nearly 3 to 1. Up to the present time this is the only generalization which can be made.

In the wild cherry (*Prunus serotina*) each leaf is conduplicate, and on account of the phyllotaxis being two-fifths, the leaves, taken in the order of their development, do not stand near each other; thus No. 1 covers 4 and 6, No. 2, 5 and 7, etc.,— therefore giving no distinct imbrication or convolution. It was observed that the leaf spiral was either with, or opposite to, the hands of a watch, and as it was followed around, came first either to the midrib or folded edges of the leaves, giving rise to four different cases, as the following table will illustrate.

Midrib first	with hands of watch	13
	opposite hands of watch	9
Edges first	with hands of watch	16
	opposite hands of watch	12

We see, out of the fifty buds examined, they were quite evenly distributed among the four cases. In one instance the four kinds were found in succession in passing up a stem.

General Meeting. May 16, 1877.

The President, Mr. T. T. Bouvé, in the chair. Thirty-two persons present.

The following papers were read:—

Notes on the Mineralogy and Petrography of Boston and Vicinity. By M. Edward Wadsworth, Instructor in Mathematics and Mineralogy in Harvard University.

The first question, that a student of the mineralogy or geology of Eastern Massachusetts usually asks, is what has been done by others; and it has seemed best to preface this paper by giving a list of most of the published articles relating to this district that can be considered to pertain in any degree to those sciences. The list will probably not be found complete, but such as it is, I hope it will save, to some extent, the time of others who have occasion to study in this field. The list is confined chiefly to the parts bordering on the sea coast, and is somewhat variable in its extent.

Memoirs of the American Academy.

1st Series.

Vol. III, p. 127. Mineralogical Observations made in the environs of Boston in the years 1807 and 1808. S. Godon.

Vol. IV, p. 129. Outlines of the Mineralogy and Geology of Boston and Vicinity, with a geological map. By J. F. & S. L. Dana.

Proceedings of the American Academy.

Vol. II, p. 270. Mansfield Coal Formation at Nahant. L. Agassiz.

Vol. II, p. 282. Origin of Contorted Strata in Sand. Edward Desor.

Vol. III, p. 315. Proofs of the Protozoic Age of some of the Altered Rocks of Eastern Massachusetts. W. B. Rogers.

Vol. IV, p. 353. Granite as a Building Material. Chief Justice Shaw.

Vol. VI, p. 167. Minerals from Rockport. C. T. Jackson.

Boston Journal of Philosophy and Arts.

Vol. I, p. 91. Rocking Stone at Roxbury. J. W. Webster.

Vol. I, p. 95. Stoneham Marble. " " "

Vol. I, p. 390. Green Feldspar from Beverly. " " "

Vol. I, p. 599. Green Feldspar and Zircon from Beverly. J. W. Webster.

Vol. II, p. 104. New Locality of Apatite. J. W. Webster.

Vol. II, p. 277. Remarks on the Geology of Boston and Vicinity. J. W. Webster.

Vol. III, p. 486. Remarks on the Geology of Boston and its Vicinity, continued. J. W. Webster.

Vol. III, p. 492. Andalusite of Westford. J. W. Webster.

Vol. III, p. 588. A Sketch of the Mineralogy of Gay Head and of Bird Island, etc. H. A. S. Dearborn.

American Journal of Science and Arts.

1st Series.

Vol. III, p. 232. Salem Sienite, Jasper, Amygdaloid, etc. Elias Cornelius.

Vol. III, p. 364.	Epidote at Nahant. J. W. Webster.
Vol. IV, p. 50.	Fluor Spar at Seekonk. T. H. Webb.
Vol. IV, p. 55.	Discovery of Hypersthene. J. W. Webster.
Vol. IV, pp. 217–239.	Volcanoes and Volcanic Substances. Thomas Cooper.
Vol. V, p. 402.	Sphene at Seekonk. T. H. Webb.
Vol. VII, p. 59.	The Roxbury Rocking Stone. J. Porter & T. H. Webb.
Vol. VIII, p. 228.	Minerals at Dedham and Seekonk. T. H. Webb.
Vol. XXII, p. 1.	Report on the Geology of Massachusetts. Edward Hitchcock.
Vol. XXIII, p. 405.	Anthracite at Wrentham. S. Day.
Vol. XXVII, p. 340.	Lowell. Geological Facts.
Vol. XXXIV, p. 402.	Columbite and Tin Ore at Beverly. C. U. Shepard.
Vol. XXXV, p. 192.	Green Feldspar and Galena at Beverly and Dedham.
Vol. XLVI, p. 318.	On the Tertiary Strata of Martha's Vineyard. C. Lyell.
2d Series.	
Vol. II, p. 419.	Gold at Dedham. J. H. Blake.
Vol. X, p. 80.	On a supposed New Mineral Species. Henry Wurtz.
Vol. XII, p. 209.	Paracolumbite from Taunton. C. U. Shepard.
Vol. XVIII, p. 198.	Crystalline Limestone of Eastern Mass. T. Sterry Hunt.
Vol. XXII, p. 296.	Discovery of Palaeozoic Fossils in Eastern Mass. W. B. Rogers.
Vol. XXIX, p. 65.	On Sodalite and Elaeolite from Salem. J. P. Kimball.
Vol. XXIX, p. 145.	Cretaceous Strata at Gay Head. Wm. Stimpson.
Vol. XXXIII, p. 348.	On Orthite from Swampscot. David M. Balch.
Vol. XXXVII, p. 359.	On Shepard's Paracolumbite. F. Pisani.
Vol. XLII, p. 73.	Danalite, a new mineral species from the Granite of Rockport. J. P. Cooke, Jr.
Vol. XLIII, p. 217.	On Cryophyllite, a new mineral species of the Mica Family, with some associated minerals, in the Granite of Rockport. J. P. Cooke, Jr.
Vol. XLIV, p. 224.	On a new mineral from Rockport. W. J. Knowlton.
Vol. XLIX, p. 75.	On Laurentian Rocks in Eastern Mass. T. Sterry Hunt.
Vol. XLIX, p. 183.	Labradorite Rock on Marblehead Neck. T. Sterry Hunt.
Vol. XLIX, p. 398.	Labradorite Rocks at Marblehead. T. Sterry Hunt.
Vol. L, p. 83.	On the Geology of Eastern New England. T. Sterry Hunt.
3d Series.	
Vol. I, pp. 82–182.	Notes on Granitic Rocks. T. Sterry Hunt.
Vol. X, p. 364.	On the Post-pliocene fossils of Sankoty Head. Verrill and Scudder.

PROCEEDINGS OF THE BOSTON SOCIETY OF NATURAL HISTORY.

Vol. I, p. 96.	Dendritic Markings on Slate from Newton. J. E. Teschemacher.
Vol II, p. 131.	Drift in South Boston. Chas. Stodder.
Vol. III, p. 79.	Drift Fossils from Nantucket. Edward Desor.

Vol. III, p. 127.	Pudding Stone from Roxbury. C. T. Jackson.
Vol. III, p. 183.	Drift in Cambridge near Mt. Auburn. Louis Agassiz.
Vol. III, p. 341.	Fossiliferous Strata at Nahant. Louis Agassiz.
Vol. IV, p. 9.	Fossils from Pt. Shirley. Wm. Stimpson.
Vol. IV, p. 170.	Syenite of Nahant. C. T. Jackson.
Vol. V, p. 24.	Boulders at Salem and Danvers. Chas. Pickering.
Vol. V, p. 314.	Serpentine of Lynnfield. C. T. Jackson.
Vol. V, p. 339.	" " " A. A. Hayes.
Vol. VI, p. 19.	Excursion of the Society to Hingham.
Vol. VI, p. 27.	Fossils from Braintree. W. B. Rogers.
Vol. VI, p. 30.	Argillite of Charlestown. A. A. Hayes.
Vol. VI, p. 40.	Fossils from Braintree. W. B. Rogers.
Vol, VI, p. 42.	" " " " " "
Vol. VI, p. 107.	Analysis of Slate from Somerville. L. M. Dombach.
Vol. VI, p. 167.	Cementing Material of the Roxbury Conglomerate. A. A. Hayes.
Vol. VI, p. 217.	Slate Rocks of Governor's Island in Boston Harbor. W. B. Rogers.
Vol. VI, p. 294.	Supposed Meteoric Stone from Marblehead. C. T. Jackson.
Vol. VI, p. 369.	Fossils from Braintree. Chas. Stodder.
Vol. VII, p. 183.	Roxbury Conglomerate. C. T. Jackson.
Vol. VII, p. 283.	On some Sub-peat Deposits of Diatomaceæ. A. M. Edwards.
Vol. VII, p. 354.	Roxbury Conglomerate. C. T. Jackson.
Vol. VII, p. 357.	Black Slate of Braintree. Jules Marcou.
Vol. VII, p. 396.	On the Primordial Fauna and the Taconic System. Jules Marcou.
Vol. VII, pp. 419–427.	Fossils from Braintree. W. B. Rogers.
Vol. VIII, pp. 1–5.	" " " Albert Ordway.
Vol. VIII, p. 58.	" " " C. T. Jackson.
Vol. IX, p. 57.	Conglomerate of Hingham and Roxbury. Bouvé and Jackson.
Vol. XI, p. 27.	Glacial Beds at Gloucester. N. S. Shaler.
Vol. XI, p. 132.	Diatomaceous Mud from Cohasset. Chas. Stodder.
Vol. XII, p. 150.	Drift at Salem and Cambridge. A. Hyatt.
Vol. XII, pp. 244–364.	Shells found at great depth at Ft. Warren. W. H. Niles.
Vol. XIII, p. 172.	Relations of the Rocks in the Vicinity of Boston. N. S. Shaler.
Vol. XIII, p. 177.	Reply to the Preceding. C. T. Jackson.
Vol. XIII, p. 196.	Glacial Drift in Eastern Mass. N. S. Shaler.
Vol. XIII, p. 277.	Glacial Moraines near Watertown. N. S. Shaler.
Vol. XIII, p. 414.	Physical Features of Massachusetts. W. H. Niles.
Vol. XIV, p. 45.	On the Geology of the Vicinity of Boston. T. Sterry Hunt.
Vol. XIV, p. 91.	Drift at Salem. Chas. Pickering.
Vol. XIV, p. 91.	Geology of Swampscott, etc. A. Hyatt.

Vol. XIV, p. 128.	Conglomerate at Chestnut Hill. W. H. Niles.
Vol. XIV, p. 190.	Eozoonal Limestones of Eastern Mass. L. S. Burbank.
Vol. XIV, p. 199.	" " " " " J. B. Perry.
Vol. XV, p. 1.	Conglomerate Rocks at Chestnut Hill Reservoir. W. H. Niles.
Vol. XV, p. 219.	Geology of Martha's Vineyard and Nantucket. N. S. Shaler.
Vol. XV, p. 262.	Eruptive Granites of Rockport. T. Sterry Hunt.
Vol. XVII, p. 200.	On a newly discovered Lead Vein in Newburyport. R. H. Richards.
Vol. XVII, p. 388.	Notes on the Geology of Eastern Mass. W. W. Dodge.
Vol. XVII, p. 462.	Chemical Composition of some Minerals from Newburyport. Miss Ellen H. Swallow.
Vol. XVII, p. 486.	Boston Artesian Well and its Waters. T. Sterry Hunt.
Vol. XVII, p. 488.	Geological Relations of Boston and Narragansett Bays. N. S. Shaler.
Vol. XVII, p. 507.	The Physical Features of Massachusetts. W. H. Niles.
Vol. XVII, p. 508.	Remarks on the Preceding. T. Sterry Hunt.
Vol. XVIII, p. 182.	Post-pliocene Fossils from Sankoty Head, Nantucket. S. H. Scudder.
Vol. XVIII, p. 217.	On the Origin of Porphyry. Thomas T. Bouvé.
Vol. XVIII, p. 220.	Remarks on the Porphyries of Marblehead. A. Hyatt.

MEMOIRS OF THE BOSTON SOCIETY OF NATURAL HISTORY.

Vol. I, pp. 251–253.	On the Glacial Phenomena of Labrador and Maine. A. S. Packard, Jr.

PROCEEDINGS OF THE GEOLOGICAL SOCIETY OF LONDON.

Vol. IV, p. 31.	On the Tertiary Strata of Martha's Vineyard. C. Lyell.

QUARTERLY JOURNAL OF THE GEOLOGICAL SOCIETY OF LONDON.

Vol. V, p. 340.	On the Tertiary and more recent deposits in the Island of Nantucket. E. Desor and E. C. Cabot.

JOURNAL OF THE ESSEX COUNTY NATURAL HISTORY SOCIETY.

Vol. I, p. 78.	A Sketch of the Geology and Mineralogy of the southern part of Essex County. Wm. Prescott.
Vol. I, p. 120.	The Danvers Bowlder, or Ship Rock.

PROCEEDINGS OF THE ESSEX INSTITUTE.

Vol. I, p. 19.	Sienite of South Danvers. A. Nichols.
Vol. I, pp. 151–153.	Cancrinite, Pyrite and Zircon in Salem. A. P. Chute and G. L. Streeter.
Vol. II, p. 39.	Geology of Manchester. B. F. Mudge.
Vol. II, p. 47.	The Minerals of Lynnfield. A. P. Chute.
Vol. II, p. 291.	Geology and Mineralogy of Lynnfield. B. F. Mudge.

Vol. II, p. 306.	Geology of Marblehead. James H. Gregory.
Vol. II, p. 385.	Geology of Middleton. B. F. Mudge.
Vol. II, p. 406.	Geology of Groveland. " " "
Vol. III, p. 15.	Gravel Pits of Topsfield. Samuel Todd,
Vol. III, p. 49.	The Local Geology of Topsfield. S. S. Mackenzie.
Vol. III, p. 85.	Geology of Boxford. Sanborn Tenney.
Vol. III, p. 89.	Serpentine in Lynnfield. S. Barden.
Vol. III, p. 96.	Geology of the Coast Region. J. J. H. Gregory.
Vol. III, p. 101.	Geology of Lynn. " " " "
Vol. III, p. 109.	Geology of Middleton. " " " "
Vol. III, pp. 205, 206.	Geology and Mineralogy of Rockport. Barden, Alger, Gregory and others.
Vol. III, p. 231.	Lithology and Mineralogy of Rockport. S. Barden.
Vol. III, p. 269.	Geology of Powow Hill. J. J. H. Gregory.
Vol. III, p. 280.	Mineralogy of Salem Neck. H. Wheatland.
Vol. IV, p. 48.	Moraine in Beverly. G. W. Skinner.
Vol. IV, p. 55.	Ship Rock, etc. S. Barden.
Vol. IV, p. 61.	Devil's Den. S. Barden and H. C. Perkins.
Vol. IV, p. 152.	Mineral Point Mine, Georgetown.
Vol. IV, p. 163.	Sand in Newburyport. Henry C. Perkins.

Communications to the Essex Institute.

Vol. IV, p. 3.	On the Sodalite at Salem. D. M. Balch.
Vol. IV, p. 6.	On Magnetite and an unknown Mineral at Nahant G. H. Emerson.
Vol. V, p. 157.	Geology of Andover. C. H. Hitchcock.
Vol. VI, p. 43.	Geology of Marblehead. J. J. H. Gregory.
Vol. VI, p. 47.	Copper Mines of Topsfield.
Vol. VI, pp. 51, 52.	Geology of Salem. A. Hyatt and S. Todd.

Bulletin of the Essex Institute.

Vol. I, p. 59.	Notice of a singular Erratic in Lynn, known by the name of "Phaeton Rock." C. M. Tracy.
Vol. I, p. 106.	Geological Description of New England Granite Formation. T. Sterry Hunt.
Vol. I, p. 144.	Eozoön Canadense. E. Bicknell.
Vol. II, p. 93.	Eozoön in Essex County. A. Hyatt.
Vol. II, p. 111.	Geology of Marblehead Neck. A. Hyatt.
Vol. III, p. 49.	On the Geological Survey of Essex Co. A. Hyatt.
Vol. III, p. 53.	Notes on the Geology of Eastern Mass. T. Sterry Hunt.
Vol. III, p. 128.	Phaeton Rock. F. W. Putnam.
Vol. III, p. 129.	Wigwam Rock. Jones Very.
Vol. VI, p. 142.	Lead Mine at Rocky Hill, West Newbury. Alfred Osgood
Vol. VI, p. 158.	Account of the Agassiz Bowlder. John Robinson.

Vol. VI, p. 205. Remarks on the Lead Ore of West Newbury. Osgood and Knowlton.

Vol. VII, p. 108. Notice of the Mining Lands of Newbury. A. Osgood.

PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Vol. IV, p. 313. Paracolumbite from Taunton. C. U. Shepard.

Vol. VI, p. 275. Ou the Distribution of Manganese. D. A. Wells.

Vol. XX, p. 1. Address of Ex-President Hunt.

Vol. XX, p. 262. On the Eozoön Canadense in the Crystalline Limestones in Eastern Mass. L. S. Burbank.

Vol. XX. p. 270. On the "Eozoön" Limestone of Eastern Mass. J. B. Perry.

TRANSACTIONS OF THE AMERICAN PHILOSOPHICAL SOCIETY.

Vol. VI, p. 411. Observations on the Geology of the U. States, explanatory of a Geological Map. Wm. Maclure.

New Series.

Vol. I, p. 1. Observations on the Geology of United States; with map. Wm. Maclure.

Special Publications in which references to the Geology and Mineralogy of this region may be found.

References can be found in most text books on Mineralogy and Geology. I shall therefore only give the more important ones.

Hitchcock's Special and Final Reports on the Geology of Massachusetts.

A Catalogue of American Minerals, with their Localities. Samuel Robinson

An Elementary Treatise on Mineralogy and Geology. 2 editions. Parker Cleveland.

A System of Mineralogy. 5 editions. J. D. Dana.

Manual of Mineralogy. 2 editions. J. D. Dana.

Text Book of Mineralogy. Edward S. Dana.

Phillips' Mineralogy. Francis Alger.

Treatise on Mineralogy. 3 editions. C. U. Shepard.

Manual of Geology. 2 editions. J. D. Dana.

Text Book of Geology. 2 editions. J. D. Dana.

Travels in N. America. C. Lyell.

Travels in U. States. Second visit. C. Lyell.

Chemical and Geological Essays. T. Sterry Hunt.

Geology. Sanborn Tenney. 2 editions.

Elementary Geology. Edward Hitchcock. 32 editions.

American Geology. Ebenezer Emmons.

Report on the Geological Map of Massachusetts. W. O. Crosby.

Geological Description of Massachusetts. By C. H. Hitchcock, in Walling's Atlas of Massachusetts.

Question Guide to the Environs of Boston. N. S. Shaler.

THE INTRUSIVE ROCKS IN THE VICINITY OF BOSTON.

It is proposed in this paper to discuss only part of the intrusive rocks to be found within the limits of Somerville, Malden, Medford, Brighton, Cambridge, Brookline, and Roxbury, and bounded principally by the porphyritic felsites and the medial line of the conglomerate.

The country rock in which these intrusives occur is principally an argillite, with varying dip, and a conglomerate; in this there occur five *apparently* different varieties of intrusive rocks.

In order to separate my views and theories from the facts observed, I shall, when possible without too great violence to the general appearance of these rocks, give them for the present the names by which they have been known heretofore, reserving my deductions for a later portion of this paper.

The first class is typically represented at the prehnite locality of Somerville, and is ordinarily known as "granite," "syenite," or "diorite."

The second class occurs in narrow dikes, which President Hitchcock calls "trap" in his Reports.

The third class is composed of the well known "greenstones" of this vicinity.

The fourth class is typically represented on Fremont Street, Somerville, and has been called "granite" and "limestone," but for the present it may be well to call it "porphyry."

The fifth class is the so-called "amygdaloid" of Brighton. It is not intended to discuss the amygdaloid in this paper, but to confine it to the first four varieties named.

I shall first give a list of localities, and the rocks to be found in them, and afterwards describe part of them more in detail.

LOCALITIES IN SOMERVILLE.

1. Head of Granite Street, off Somerville Avenue. The rock here is the "diorite" of the prehnite locality.
2. Corner of Somerville Avenue and Lowell St., — "greenstone."
3. On Lowell Street, midway between Somerville Avenue and Summer Street, — "greenstone."
4. In the triangle formed by Broadway, Holland, and James Streets, — "greenstone."
5. Newbury Street, near Broadway, — "greenstone."

6. Argillite quarry near the Cambridge Alms House, — "greenstone" and "trap."

7. Elm Street, northwest side, an argillite quarry with three dikes of "trap," one of "greenstone" and one of "porphyry." The trap shows in the westerly dike the usual prismatic jointing. The middle trap dike faults the "porphyry," the opposite parts being laterally separated by about six feet. The same dike also cuts the greenstone, showing that it is of more recent date than either the "porphyry" or "greenstone." The easterly dike extends on both sides of Elm St., and is porphyritic by reason of crystals of clinoclase and some calcite. Several layers of sandstone are found in this quarry as well as in others in the argillite which closely resemble that found in connection with the conglomerate at Brighton. The "porphyry" in its passage through the slate and sandstone, takes various directions, horizontal, perpendicular and oblique, inclined to the north.

8. On Chandler St., near the last mentioned quarry, there are three "trap" dikes and one of "greenstone."

9. Between Elm and Willow Streets, also on both sides of Willow St., and on Appleton St., the "greenstone" outcrops in several places; and the "trap" is to be seen on the west end of Appleton St. and the east side of Willow St.

10. Near the old "Powder House," corner of Elm St. and Broadway, — "diorite."

11. Fremont St., — "greenstone" and "porphyry." This is the best location of the latter, which is here almost interstratified with the argillite, but shows its intrusive character by its shoulders and branches, also by its breaking across the stratification in some places.

12. In that part of Somerville included between Mystic Avenue, Temple, Bond, Heath and Brooks Streets, numerous quarries exist, and very many outcrops of "trap" and "greenstone" occur.

13. Between Bond and Heath Streets, — "trap."

14. Near the centre of Vernon St., — "porphyry," or a decomposing "greenstone."

15. Adams' Ledge on School St., opposite Howe St., — "trap" and "greenstone."

16. Corner of Marshall and Pearl Streets, — "greenstone."

17. West corner of Walnut and Pearl Streets—"greenstone"; and on the east corner — "trap."

18. Wigglesworth St., opposite Everett Avenue, a "trap" dike faults a large "greenstone" one, and occasions in the contiguous argillite a prismatic jointing, perpendicular to the walls of the dike, similar to the usual jointing of dikes.

19. On Wigglesworth St., near Bonair St., a "porphyry" dike occurs, which was traced to quite a distance when the cellars were excavated along Bonair St.

20. Near Walnut St., between Bonair St. and Broadway, three "trap" dikes and several of "porphyry" or altered "greenstone" are seen.

21. Corner of Crescent and Washington Streets "greenstone," which here well shows its junction with the indurated argillite and sandstone. The "greenstone," through alteration, is sometimes amygdaloidal in appearance, and, further, contains much epidotic matter, which is to be found in many of the "greenstones" and other rocks to the northward of Boston.

LOCALITIES IN MALDEN.

1. In the space included by Ferry, Upham, Franklin and Haskins Streets, three outcrops of the "greenstone" occur, one near Upham St., the second to the eastward, and the third to the northward of the first.

2. Near the "Old Cemetery" on Tufts Avenue and Green St.,— "diorite."

LOCALITIES IN MEDFORD.

1. West side of Forest St., corner of High St., — a series of quarries in the "diorite."

2. Corner of Main and Dexter Streets, — a dike of "greenstone," one of "porphyry," and one of "trap."

3. On the Medford Turnpike or Mystic Avenue an outcrop of "greenstone" is to be seen, which is very much altered, and resembles closely an impure decomposing felsite on its surface. It can be traced for about half a mile into Somerville. It is one of the widest of the "greenstone" dikes, and at one time formed a high bluff, whose foot was washed by the Mystic.

BRIGHTON.

1. On Cambridge St., between Union Square and Warren St., by the Brighton Water-works, there are four "trap" dikes in the "amygdaloid," one of which ends quite abruptly in it.

2. At the corner of Brighton Avenue and South Harvard St. two "trap" dikes cut the "amygdaloid," changing their direction considerably in the passage, the mean direction being about N. 55° E.

BROOKLINE AND ROXBURY.

In Brookline and Roxbury many "trap" and "greenstone" dikes are to be seen. On Tremont St., between Parker and Francis Streets, seven "trap" dikes and one of "greenstone" occur; three of the "trap" dikes stand side by side, separated only by narrow bands of conglomerate. The "greenstone" here runs about N. 25° W., differing much in direction from the other "greenstones." In Brookline, on Washington St., between Allston and Beacon Streets, a "trap" dike is seen, showing an abrupt change in part of its course for a short distance.

The directions of all these intrusive rocks have been as carefully ascertained as they well could be with a common pocket compass. Many of them are strongly magnetic, so much so that pieces may be lifted with a magnet. This strong magnetism renders the obtaining of their true direction, in many cases, quite difficult. The direction for the same kinds of rock varies somewhat in different parts of the dikes, but in general it is the same. Their general direction to the true meridian (the correction for which I am indebted to Mr. A. Searle of the Phillips Observatory) is as follows: "Diorites," N. 40° E.; "Traps," N. 40° E.; "Greenstones," N. 60° W.; "Porphyry," N. 40° W.

Special Description.

"Diorite."

GRANITE STREET, OFF SOMERVILLE AVENUE, SOMERVILLE.

This locality is one of the best and longest known in this vicinity, being the famous prehnite quarry of Milk Row, Charlestown, which is the name now given in our mineralogies to this locality, Somerville formerly having been a part of Charlestown.

In the Danas' Geology of Boston, the rock is described as a greenstone, which they define as a granular aggregate of hornblende and feldspar (pages 163–201). In Cleaveland's Mineralogy the same designation is applied to it. In the mineralogies of Dana, Blum and Alger, it is called sienite. Dr. Webster, in the Boston Journal of Philosophy and Arts, Vol. II, pages 282–286 calls this a "sienitic greenstone," and in his paper, as well as in the Danas', a good description of the decomposition of this rock, both in this and in other localities, can be found, together with its formation of boulders *in situ*. President Hitchcock mentions this rock in several places under the head of greenstone in his final report on the Geology of Massachusetts, however quoting mainly from Dr. Webster's paper. In the paper of Mr. W. W. Dodge,[1] it is described as "ranging from feldspathetic to hornblende rock, often very micaceous, sometimes granitic by the absence of hornblende." Mr. W. O. Crosby, in his Report on the Geological Map of Massachusetts, (page 11) calls this an "exotic diorite," and considers it probably of the Norian Age, making it the same as his "Norian Rocks" of Nahant, Marblehead and Salem. In the papers referred to, all agree in one thing, that, in general, the rock is composed of feldspar and hornblende.

The general appearance of the rock varies to quite an extent; in some places it is light brown or reddish from the predominance of feldspar, in others dark green to quite black. It breaks up into irregular blocks, which by disintegration form rounded boulder-like masses, and yield a reddish brown sand. All the other large dikes, as well as part of the smaller trappean ones, disintegrate in the same way. The resulting sand is composed chiefly of feldspar and altered biotite or rubellan. Veins of reddish feldspar and of feldspar and hornblende extend through many parts of the rock.

The stone from this and other localities of the same kind, has been used to a considerable extent in Boston, Cambridge, Medford, Malden, Somerville, Brighton, and other towns, for basement walls, under pinning, steps, posts, fence walls, etc., and, when it is used above ground it compares very favorably with the other building stones used beside it, especially when hewn, a fact which is quite surprising when we consider its ready disintegration in the parent bed. The oldest monument of its use in Cambridge, that I know of, is the old mile stone, now standing near Dane Hall, which bears date of 1734. The front of the building now occupied by the Cambridge Gas Light Company at Harvard Square is of this rock, and was erected in 1840. The mass of the rock is too sombre to be used to any very great extent in edifices except with lighter colored materials, and, further, it would be well to make a most careful examination of it, where it has been used, before it is either condemned or accepted as a durable

[1] Proc. Boston Nat. Hist. Soc., Vol. XVII, p. 415.

building stone. It is the principal building stone at Medford, and it can be seen on many of the streets in Boston, particularly on the older and cross streets. My thanks are due to President Eliot for information upon this subject.

Thin sections of the rock examined under the microscope show that it is composed of a triclinic feldspar, augite and magnetite, with apatite, biotite, viridite, and pyrite. The feldspar, augite, and magnetite are the essential constituents, while the viridite, and probably most of the biotite if not all of it, are the products of alteration.

The feldspar is much decomposed, being altered to viridite, prehnite, and kaolin, but shows in polarized light that it is clinoclase; the alteration to viridite commences usually in the interior of the crystal, and may be, as well as prehnite, which is of similar occurrence, the occasion of the appearance of much of the feldspar, which has a pink tinge on the outer part, and a greenish one in the centre, although this is generally considered to be owing to two different feldspars.

The augite occurs in columnar crystals penetrating, and interpenetrated by, the clinoclase, showing the contemporaneous crystallization of both. It is divided by an irregular network of fissures, and from these and the surface of the crystal the alteration to viridite begins, and crystals are to be seen in every stage of alteration, from those that are partially, to those that are wholly, changed.

The viridite arises from the alteration of the feldspar and augite. Its first appearance is amorphous, it then assumes a fibrous structure, and finally passes into biotite and other definite forms. The weight of the evidence would go to show that the viridite is the intermediate state that the minerals of this rock pass through in the course of their alteration to definite compounds. It is often found pseudomorphous after the augite.

The biotite, although it may have been partly an original constituent of the rock, comes from the alteration of the augite either directly or else passing through the viridite stage, and the evidence goes to show that the latter is the case. The reasons for assuming this are these: The apparent gradual passage from augite through viridite to biotite, as seen under the microscope; the general nonappearance of biotite only in those parts where the augite has been greatly or entirely altered; its comparative absence in the least altered portions of the rock; the abundance of the viridite in the partially changed parts, and finally the almost entire absence of the augite and viridite, and the great amount of the biotite in the more decayed portions of the rock and the resulting sand. A silvery white to greenish white mica is found in very thin scales in the rock, and from its pyrognostic characters is probably biotite, or a related mica.

The apatite is found in long, rounded and hexagonal needles, penetrating both the augite and the feldspar. In general it is unaltered, but in a few cases its cracks are filled with viridite.

The hornblende of the reddish feldspathic veins is in long, black prisms closely resembling the augite, and undergoes similar alterations. Uralite is found in small quantities. Calcite occurs in veins lining fissures, and in connection with the prehnite. Quartz is found chiefly in nodules and in irregular masses partially filling interspaces between the feldspar, in the coarser veins. It is not, however, an essential constituent of any part of the rock.

The prehnite occurs in veins lining fissures in the rock, also forming pseudomorphs after the feldspar and augite, principally the former, particularly near the veins containing prehnite, where the feldspar is partially or wholly replaced by it, as well as in the coarser parts of the rock, and near its junction with the slate. The partial alteration of the feldspar to prehnite appears to extend through considerable of the massive part of the rock, and gives rise to much of the greenish color of the feldspar when it has not been changed to viridite.

Chalcodite, which has only heretofore been found at the Sterling Iron Mine, Antwerp, N. Y., I have found in some abundance in this locality. It occurs in masses and pseudomorphs made up of minute flakes, and also in stellated groups.

Two varieties are found, one of a green bronze color, which on heating in a closed tube yields water and turns yellow, the other of a yellow bronze color. The first variety occurs on the interior, and in parts that have not been as directly exposed to atmospheric action as the yellow variety. The genesis appears to be as follows: the alteration of the original minerals to viridite, then the passage through the green bronze to the yellow bronze state, that being probably the chalcodite proper. In physical, pyrognostic and chemical characters, it closely agrees with the descriptions given by Professors Shepard[1] and Brush[2] of the Antwerp mineral, therefore it is not necessary for me to give those characters here. It takes the place of the augite,

[1] Proc. Am. Association Adv. Science, Vol. VI, p. 232.
[2] Am. Jour. Science, 2d Ser., Vol. XXV, p. 198.

feldspar and prehnite, and sometimes seems to be formed without passing through the viridite or green bronze stage. On the feldspar and prehnite it occurs sometimes as stellate coatings on the unaltered mineral, at others in stellate groups in little pits upon the surface, as well as replacing the minerals in part, or as a whole. In one feldspar crystal the alteration was observed to take place in layers parallel to O, (001).

The remaining minerals are principally magnetite and pyrite; the magnetite, when tested, showed no trace of titanium. The melanolite of Wurtz is deposited on the sides of fissures by the infiltrating waters, and assumes a striated, imperfectly fibrous shape, and gives rise to faces and appearances, similar, if not identical, with much of the so-called " slicken-sides "; on long exposure it changes from its original to a rusty brown color.

An examination of many of the rocks in this vicinity would indicate that a large number of the faces that are here called " slicken-sides " arise from a deposit of epidotic, chloritic, or other mineral matter deposited by water on the surface of pre-existing fissures, and which may or may not have been further smoothed by the attrition of running water, or by the expansive force of the water freezing in the fissures.

MALDEN.

The Malden locality is not now worked; the rock has been used to form the wall on the north side of the " Old Cemetery," near the quarry. The contact with the argillite can be seen here. The argillite is much indurated and resembles felsite. Thin sections show the rock to be composed of clinoclase, augite, magnetite, viridite, with some biotite, pyrite, and apatite. The clinoclase is very much altered. This rock, in all of its essential characters, is the same as that last described.

MEDFORD. FOREST STREET.

The specimens from this locality are mainly surface ones, therefore much altered, yet thin sections show its composition to be the same as the preceding.

The augite has in a great measure disappeared, and little viridite is found, but the biotite is very abundant.

SOMERVILLE. POWDER HOUSE.

The general structure and composition of this rock is the same as that of the foregoing localities.

The augite is much decomposed, the viridite is very abundant, while but little biotite shows in the thin section. The apatite is partly altered to viridite. Near the contact with the argillite the rock is compact and fine grained, looking like some of the coarser "traps," but a microscopic examination of it shows that it is the same as the coarser parts, except that its constituents are less decomposed and it contains a little quartz.

"Trap" Dikes.

BRIGHTON, NEAR THE WATER WORKS.

Of the four dikes here, one is about eight or ten feet in width, and at one end shows the same concentric disintegration that the "diorites" have, while the other end shows the usual prismatic jointing common to such dikes, the columns being perpendicular to its walls. This dike is a vertical one, but many of the dikes are inclined towards the east. Thin sections under the microscope show that this is of the same composition as the "diorite," particularly the compact part, near the argillite at the "Powder House," Somerville. It contains considerable viridite. Its structure and composition show that it is the connecting link between the "diorite" and "trap." Some prehnite is found in this dike.

WALNUT ST. BETWEEN BONAIR ST. AND BROADWAY, SOMERVILLE.

Thin sections show that the third dike from Walnut St. is composed of a reddish brown augite, clinoclase, magnetite, olivine and viridite; the viridite forming pseudomorphs after olivine, or partially replacing it. This dike and the middle one in this quarry, are finely porphyritic from elongated crystals of feldspar, while the other trap dike in this quarry is mainly uniform in texture. The middle dike contains clinoclase, magnetite, and viridite, forming a matrix in which larger twin crystals of clinoclase are enclosed, also partially altered crystals of olivine. But little unchanged augite is to be seen.

BOND ST., SOMERVILLE.

The "trap" here is composed of augite, clinoclase, magnetite, viridite, and also olivine, partially or wholly altered to viridite. In this there is a tendency to the formation of little spheres of decomposition, tending to give the rock a variolitic appearance.

This same structure is very prominent in some of the Roxbury dikes on Tremont St., and in Somerville, on Elm St.

ELM ST., SOMERVILLE. WESTERLY "TRAP" DIKE.

We have in this a finely porphyritic dike composed of augite, clinoclase, magnetite, and viridite, the viridite here being, as in all other cases, a product of alteration.

WIGGLESWORTH ST., OPPOSITE EVERETT AVENUE, SOMERVILLE.

Several sections of this rock were made, showing it to be composed of augite, clinoclase, magnetite, with viridite and a little olivine. Signs of flow structure are to be seen under the microscope in some sections of this and other dikes. In a section showing the junction of the dike with the argillite, it passes from a compact gray base containing crystals of feldspar (the crystals growing finer near the junction) to the argillite composed of rounded grains showing colors in polarized light. The dike, at the junction, takes up little portions of the slate and sends veinlets into it, the same as can be seen on a large scale at the junction of the "diorite" of Malden with the argillite.

The greenish and grayish base or glass found at the junction with the argillite and with the "greenstone" is undoubtedly altered tachylite; it is porphyritic from inclosed crystals of feldspar and augite, and can be found on nearly all of the smaller dikes.

EAST SIDE OF WALNUT ST., CORNER OF PEARL ST., SOMERVILLE.

The dike here contains undecomposed olivine, which is readily distinguished by the naked eye, the remaining constituents being the same as those in the rock last described.

ADAMS' LEDGE, SCHOOL ST., SOMERVILLE.

The "trap" in this quarry is coarsely porphyritic from large twin crystals of clinoclase, the composition plane being *i–ĭ*, and each part showing the characteristic striæ. These crystals are usually rounded, but show their contemporaneous origin with the matrix by containing the same inclosed minerals that it does; by being penetrated by, and by inclosing, detached portions of the matrix; by crystals of apatite and masses of magnetite extending through both the feldspar and the matrix. The minerals inclosed by the feldspar, which is probably labradorite, are apatite, magnetite, biotite, and graphite.

The mass of the rock is like all the other "trap" dikes varying from a gray to a dark gray, almost black mass, more or less compact, breaking with a conchoidal fracture, and easily fusing to a black magnetic mass. Microscopic examination of it in thin sections shows that it is much decomposed, and has a flow structure. It is composed of clinoclase, magnetite, a very little unaltered augite, olivine, viridite, apatite, and pyrite, pyrite occurring in all the intrusive rocks described in this paper. Porphyritically inclosed in the matrix, besides the feldspar, occur biotite, graphite, olivine, pyrite, hematite, apatite, serpentine, and magnetite. The graphite is in fine pure scales, the hematite arises in some cases from the decomposition of the olivine, which is here of a brownish yellow color, and on heating turns black and becomes magnetic. The apatite occurs of a brown color and in hexagonal crystals, both tabular and columnar, also in rounded columns and grains. The magnetite on test showed no trace of titanium. The olivine and magnetite contain inclosed crystals of apatite. Calcite and other products of infiltration and alteration are to be found.

"Greenstones."

MALDEN, NEAR UPHAM ST., CORNER OF FERRY.

Thin sections show that this rock is composed of augite, feldspar, magnetite, and viridite. The feldspar is so altered that no trace of its triclinic character is visible, and in other sections of this the constituent minerals are much more decomposed and changed to viridite.

MEDFORD, CORNER OF DEXTER AND MAIN STS.

This "greenstone" contains much augite, feldspar, and magnetite with a little quartz and calcite.

SOMERVILLE, WILLOW ST.

The feldspar here, although much decomposed, still shows traces in polarized light of its triclinic character. Hornblende of a yellowish color in the thin sections is found, and appears to be an alteration product. The rock further contains apatite, viridite, biotite, and magnetite, but hardly a trace of augite.

SOMERVILLE, CORNER OF LOWELL ST. AND SOMERVILLE AVENUE.

The general structure of this and of part of the other "greenstones," is essentially the same as that of the "diorites," and it is composed of feldspar, viridite, magnetite, apatite, augite, and traces of hornblende. The rock near its contact with the slate is of a dirty gray color, and under the microscope shows a gray base with crystals of feldspar porphyritically inclosed.

SOMERVILLE, QUARRY NEAR THE CAMBRIDGE ALMS HOUSE.

Composed of viridite, feldspar, magnetite, and some augite.

SOMERVILLE, WEST CORNER OF WALNUT AND PEARL STS.

This is composed principally of viridite and magnetite, with traces of feldspar, augite, and apatite.

SOMERVILLE, FREMONT ST.

This rock is finely porphyritic from elongated feldspar crystals, the matrix being composed of clinoclase, viridite, and magnetite.

ARGILLITE QUARRY, ELM ST., SOMERVILLE.

Composed of viridite, magnetite and feldspar, forming a matrix in which large feldspar crystals are embedded; these crystals are much altered, and are changed to viridite in part.

SOMERVILLE, WIGGLESWORTH ST.

Surface specimens show the "greenstone" to be composed mainly of viridite and magnetite, with a little quartz and calcite.

EAST CORNER OF MARSHALL AND PEARL STS., SOMERVILLE.

Much decomposed, composed almost entirely of viridite and magnetite.

"Porphyry."

SOMERVILLE, FREMONT ST.

The dike here is several feet in width, very coarsely porphyritic on the underside, becoming finely so towards the upper parts of the dike, where it is a compact gray mass. The porphyritic structure is owing to yellow and grayish white pseudomorphs after feldspar, augite and hornblende crystals; the pseudomorphs being composed principally of a hydrous, ferruginous, and argillaceous material containing calcite, and generally showing under the microscope a somewhat fibrous structure. The base is a mottled grayish mass, now composed principally of calcite and argillaceous matter.

ARGILLITE QUARRY, ELM ST., SOMERVILLE.

The dike here is narrow, and only finely porphyritic. Thin sections reveal a similar structure to the "porphyry" on Fremont Street, except that the alteration has not extended quite as far. A close resemblance exists in this and the upper part of the one on Fremont

Street to the rock on the boundaries of the Lowell Street "greenstone" dike.

Summary and Conclusions.

It will be seen from the foregoing that the first three classes of rocks, *i. e.*, "diorites," "traps" and "greenstones," show various degrees of alteration, from those in which the original constitutents are but slightly altered to those in which viridite and some magnetite form the entire mass of the rock, all of the original constituents having been changed to viridite, except the magnetite, that change taking place through the medium of percolating waters, and in many, if not in all cases, going on at the present time.

The "diorites" and "trap" having a common direction and composition, as well as a similar structure depending upon the width of the dike, must be taken as of the same age and as the same rock.

The "greenstones" having the same original constituents as the former, excepting their greater alterations, and in some cases closely resembling in internal structure the "diorites," should be taken as the same rock, but of a greater age.

The "porphyry" could come from altered trachytic rocks, but from its general association and its resemblance to parts of the greenstones it may be considered (provisionally at least) as belonging to the "greenstone" type, but in narrower dikes and of the same or different age.

The normal and essential constituents of these rocks were augite, feldspar, and magnetite, containing as accessories apatite, olivine, pyrite, hornblende, and perhaps some biotite.

The viridite, most of the biotite, part of the hornblende, the prehnite, chalcodite and hematite, are the products of alteration. The viridite is in many, if not in all cases, the intermediate or transition stage through which the original constituents pass in the course of their replacement by biotite, hornblende, chalcodite, etc., etc.

Many of the rocks here described have a tendency to decay from centres forming dark spots, which are often removed by percolating waters leaving cavities that are afterwards filled by infiltration, and in other cases the filling proceeds simultaneously with the removal.

This process, which can be seen in every stage in some of the dikes gives rise to much of the amygdaloidal appearance of these rocks.

All previous writers upon the rocks in the localities mentioned, who have undertaken to give their composition, have, as far as I know, considered them all to be hornblendic, except in the case of the Doctors Dana, who in their paper on the "Mineralogy and Geology of Boston and its Vicinity," on page 157, state that basalt occurs in beds in argillite at Charlestown, and in rounded masses at Cambridge and Charlestown, basalt at that time being considered to be a simple mineral.

In renaming these rocks I shall in a great measure follow the views so ably advocated by Mr. S. Allport in the Geological Magazine, and in the Quarterly Journal of the Geological Society, that intrusive rocks of the same composition should not be given different names according as they are considered to be older than the Tertiary age or not, and that as the chloritic material is solely a product of alteration it should not be made a fundamental basis for their classification.

These rocks answer to the common definitions of diabase and melaphyr, if they are older than the Tertiary, but rejecting the limitation of age (and in this case it is unknown at present), they should be classed as dolerites and basalts, the difference being merely the more compact state of the last, and employing the term dolerite, as suggested by Mr. Allport, as the generic name, retaining, if desirable, the terms diabase and melaphyr to simply indicate altered forms of dolerite and basalt.

The results of the examination of these rocks will be found similar to those obtained by Messrs. Allport, J. A. Phillips, E. S. Dana, Hawes and others, in their examinations of similar rocks.

These rocks offer a fruitful field for accurate chemical analysis, and for more extended microscopic observations; from what examinations I have been able to make outside of the field chosen for this paper, and from specimens in the collections of others, there is but little doubt that these rocks are very wide-spread in Eastern Massachusetts, and that a more extended study of them, and of the other intrusives in this region, would aid much in simplifying its complex geology.

I would like to urge here that rocks should be most carefully examined in the field as well as in the cabinet, and, when possible, by the same observer, for even in this limited region, and from these dikes, specimens can, and have been collected, as typical ones, that in the cabinet, and even in thin sections, would be, and have been, pronounced to be basalt, diabase, melaphyr, syenite, aphanite, diorite, impure limestone, chlorite-schist, etc., etc.

A want of time and the pressure of my other duties compels me to present this paper without the further investigations that should be made, especially as no two sections of the same rock will tell exactly the same story; I must therefore look to the future to substantiate or overthrow my conclusions.

Although no one but myself is responsible for the ideas put forth, or the errors contained in this paper, I desire to acknowledge my indebtedness to Professor Cooke, who kindly allowed me the use of his magnificent microscope, polariscope, and foreign collection of thin sections; to Professor Pumpelly, who, although I had not the slightest claim upon him, most kindly taught me to make my own thin sections, and gave me much valuable instruction; to Professors Whitney, Hunt, Shaler, Huntington and others, for the privilege of examining their lithological collections, and for other favors.

On the Granite of North Jay, Maine.

By M. Edward Wadsworth.

The granite quarries at this place are located upon a ridge of granite that rises to the height of two to three hundred feet above the M. C. R. R. station, and extends in a north and south direction for about half a mile.

The country rock is a mica schist. The granite has the usual concentric and cross jointing. In some parts it is quite gneissoid, and in the southern and central parts of the hill is much intersected by veins and coarse patches of granite, the best and finest rock being on the northern portion.

The granite is composed of orthoclase, clinoclase, muscovite, biotite and quartz, and in the veins and coarser parts tourmaline, beryl and garnet occur.

The clinoclase, determined by the method of Des Cloizeaux (Comptes Rendus, Vol. LXXXII, page 1017) is found to be oligoclase.

The orthoclase shows well in polarized light the cross-hatching described by Hull, Rutley and others.

The quartz and feldspar show under the microscope the usual inclosures, and the quartz in some places is filled with trichites, closely resembling the usual "macroscopic" inclosures of rutile.

The micas were examined under the polariscope, showing that the black one was uniaxial, while the silvery white one was biaxial, giving the following apparent inclination for the axes in the air.

First specimen, mean of fifteen measurements, 69° 59′.

Second specimen, mean of six measurements, 72° 21′.

Third specimen, mean of three measurements, 67° 9′.

The axes lie in the plane of the longer diagonal.

Fusibility of the Amorphous Varieties of Quartz. By M. Edward Wadsworth.

Having occasion to examine and separate a number of specimens of jasper from felsite, I was led to doubt the usual statements that quartz in all its varieties is unaltered and infusible before the blowpipe, and that jasper can be distinguished from felsite by the former being infusible, while the latter is fusible on the thin edges.

I found on examining many specimens of chalcedony, agate, jasper, flint, opal, etc., that all fused from 5 to 6+, except some of the jasper; many of the specimens of chalcedony swelling to twice their normal size, curling in the flame, turning white, and forming a white enamel or blebby glass.

The fusibility of these varieties is doubtless owing to various bases existing as impurities in the quartz. That in hand specimens jasper may be separated from compact feldspathic rocks by means of its fusibility may be true, but until it is settled by chemical or microscopical analysis, what shall be called jasper, and what felsite, the distinguishing line seems, at least, to be obscure.

The blowpipe used (Bunsen's gas blowpipe) gives a somewhat higher temperature than the common blowpipe, but in the only case tried, chalcedony was fused by means of a common blowpipe and a small alcohol lamp.

Mr. S. H. Scudder exhibited drawings of the wing of a cockroach from the carboniferous formation of Pittston, Penn., in the possession of Mr. R. D. Lacoe of that place.

It lies on a piece of black carbonaceous shale, and was found in the interconglomerate beds, or at not far from the same level as the fossil cockroach described by Lesquereux from Frog Bayou, Arkansas. It is a nearly perfect upper wing, an insignificant portion of the extreme tip and base only wanting. It may be called *Blattina fascigera* from the grouping of most of the principal nervules into bundles, although this feature is not very conspicuous. The anal vein is very deeply impressed; the marginal area is very broad and in its basal half almost entirely devoid of cross veins; the entire margin of the apical half of the wing is broken by nearly straight and equidistant cross veins over a large area, while the disc of the wing is irregularly reticulated. The costal margin is very broadly and gently convex, and the inner margin nearly straight, so that the wing is of nearly equal breadth throughout. Its length (with broken tip) is 35 mm., probably it was about 38 mm. long; its breadth is 15.5 mm. The species seems to be somewhat nearly allied to *Blattina primæva* Gold. of the European carboniferous formation, but differs distinctly in the extreme weakness of the scapular vein, its nearly uniform distance from the margin throughout its course, and its continuation nearly to the tip of the wing.

A full description and figure of the species will be given in a future paper.

Dr. T. M. Brewer announced a very interesting addition to the Society's collection of New England fauna, viz.: a mounted specimen of the Chestnut-collared Longspur, *Plectrophanes ornatus* Townsend.

It was shot by Mr. C. W. Townsend in a grass field near the shore at Magnolia, between Gloucester and Manchester, Mass., July 28, 1876. It is an adult male, but showing no signs of breeding. The plumage was much worn, and indicated an incipient moult. The dimensions are: length, 5.65 in.; expanse, 9.75; wing, 3.21; tail, 2.32; bill, .38; tarsus, .86; hind claw, .33; middle claw, .22. It was alone, and while flying uttered two notes. This species is abundant in the plains of the upper Missouri, where the first single specimen was taken by Mr. Townsend, and described in 1837. It was found in May, on the Platte, by Nuttall, and by Mr. Allen in western Kansas; the highest known range is on the Saskatchewan Plains. In its migrations it has been taken in southern Texas and the Indian Territory. No specimen before this is known to have been taken within two thousand miles of the present locality. As Mr. Townsend was the first to discover this species, it is not inappropriate that a namesake should be the first to meet with it in New England.

A vote of thanks to Mr. Townsend for this gift was passed.

Dr. Brewer also presented the following papers:

NOTES OF A FEW BIRDS OBSERVED AT NEW PROVIDENCE, BAHAMAS, NOT INCLUDED IN DR. BRYANT'S LIST OF 1859. BY L. J. K. BRACE.

Dendroica dominica. Two specimens seen, one shot, Sept. 30, 1876, in the "Pine Barren," the other seen Oct. 22, 1876; both were in full plumage.

Passer domesticus. House Sparrow, introduced within the last few years.

Coccyzus minor. "Rain Crow, or Cotoo"; probably a contraction of Cuckoo. Is tolerably abundant, and not at all a shy bird.

Hirundo bicolor. During the stormy weather of Dec. 1st and 2d of last year, a number of these birds were to be seen flying about. On the 1st I saw only three, but on the 2d a great many, which flew very low, close to the ground; two flew inside the house and clung for a few minutes to the edge of a shelf, but before they could be secured flew out again. On the 4th, the weather moderating, not one was to be seen.

Athene cunicularia. Killed Dec. 20, 1876. For about a month past I had been watching a small owl that was in the habit of foraging up and down the wharfs that line one side of the harbor of Nassau. As dusk approached, he would make his appearance and perch on some elevated place, such as a post, or part of a fence. On the approach of any one to his resting place, he would allow them to come within about twenty feet, but if approached nearer, no matter how cautiously, he would fly off, generally uttering a shrill and quickly reiterated chur-chur-chur-chut! to another spot, scarcely ever returning to the same one. Some evenings he was more vociferous than on others. I could not determine where he retired during the day, but he would generally arrive from a southerly, inland direction; at other times from either the east or west end of the wharfs. When shot, he had only come a short time, and was perched on the cross trees of a flagstaff, about fifteen feet high. From part of the contents of the gizzard, I concluded it was attracted by the "Crawlers," a species of Ligia that abounds on the sides of the wharfs; it also contained the half digested remains of a Hyla. I have frequently heard the note of this owl of an evening. I have seen one, stationary, over the seashore, facing a pretty strong northwest wind. And again, at daybreak one morning, I was passing along the road and an owl rose from the shore (fringed by a low growth of shrubs) and passed over the road in front of me — so that here it appears to be rather a *night owl*, and not exclusively diurnal. The owls here are called indiscriminately "Screech Owls." Its dimensions are: Length, $8\frac{3}{4}$; alar, 23; tail, 3.0; tarsus, $1\frac{4}{8}$; culmen (chord) tip to cere $\frac{19}{32}$; culmen (whole chord) $\frac{3}{4}$; wing $6\frac{1}{2}$; iris fine yellow.

Geotrygon Martinica. One of the birds called "Wood Doves," the *Zenaida amabilis* being also called "Wood Dove." This beautiful bird is frequently met with in the coppices underneath the trees of which it delights to feed, preferring for this purpose those parts which are rather open beneath, and less choked up with undergrowth, its habit being to feed almost exclusively on the ground, on berries and seeds, more particularly on the berries of the "Poison Wood," on the fruit of which, amongst others, the *Patagiœnas leucocephala* feeds also. On being flushed, it scarcely, if ever, flies to any distance, generally alighting after a short curved flight. Its note is peculiarly mournful, being an expiring groan, which is rather startling to hear if the cause of it is not known.

Porzana Carolina. This bird I have shot in Dec., 1875 and 1876; only during the winter months. I have met with it in a muddy, swampy flat.

List of Birds, chiefly visitors from N. America, seen and killed in the Bahamas in July, Aug., Oct., Nov., and Dec., 1876. By N. B. Moore.[1]

1. **Sterna anglica** Mont. Aug. 6, killed on Long Island; many seen.
2. **Tringa Bonapartii** (one), Aug. 5; Fortune Island.
3. **Micropalama himantopus** (four), Aug. 5; Fortune Isl.
4. **Tringa maculosa** (two or three), Aug. 5; Fortune Isl.
5. **Tringa maculata** (several), " " " "
6. **Polioptila cœrulea** (many), " " " "

[1] The papers by Messrs. Brace and Moore are given conjointly, as both cover the same ground and are supplementary to Dr. Bryant's observations on the avifauna of the same islands.

7. **Dendrœca ?** (many), Aug. 5; same place, Inagua, Oct. 6. None were killed.

8. **Chroicocephalus Philadelphia** (one), closely observed; Long Island, Oct. 8.

9. **Charadrius virginica,** only two seen, killed; Long Island Oct. 8.

10. **Gambetta melanoleuca** (few seen), Aug. 6; Inagua.

11. **Gambetta flavipes** (seven seen), Aug. 5 and Oct. 6, at Fortune Island and Inagua.

12. **Rhyacophilus solitarius** (a few), Aug. 5; same places.

13. **Sterna frenata** (several), " " " "

14. **Ardea ludoviciana** (three), Aug. 5; Fortune Island.

15. **Stryx furcata ?** killed (three seen); Nassau, Dec.

16. **Antrostromus carolinensis,** one skinned, several seen, Dec.; Nassau.

17. **Ardetta exilis,** one, seen Jan. Near Nassau, Jan.

18. **Siurus aurocapillus,** daily seen, since Oct. 12; Nassau.

19. " **novaboracensis,** seen any day since Nov.; "

20. **Porzana carolinensis,** three seen Jan. 13; near Nassau.

21. **Helmintherus vermivorus,** five or six seen in Nov., Dec. and Jan.; Nassau.

22. **Dendrœca dominica** (one or two killed), others seen; Nov., Dec. and Jan.; Nassau.

23. **Galeoscoptes carolinensis,** three or four seen in Nov. and Dec.; Nassau.

24. **Vireosylvia flavifrons,** two only seen in Jan., first at Nassau; they were together, feeding on the berries of the Gumbo-limbo, in company with *V. crassirostris* Bryant.

25. **Hirundo bicolor,** seen on two occasions in Nov.; Nassau.

26. **Cyanospiza cyanea,** only two seen; one male Nov. 1, female, or young Nov. 1 and Nov. 13; Nassau.

27. **Accipiter columbarius,** several seen, in young and adult dress; Nassau.

28. **Coccygus minor,** killed by Mr. L. J. K. Brace, at Nassau.

29. **Spheotyto cunicularia,** killed Dec. 23, by Mr. Brace.

30. **Geotrygon Martinica.** Mr. Brace's identification; not seen by me.

Some of these should probably not be regarded as *only winter visitants*, but *residents* of the Bahamas. But as Dr. Bryant did not, in 1859, meet with them — such, for instance, as *A. ludoviciana*, *Rhy. solitarius*, *T. Bonapartii* and *himantopus*, *G. melancholica* and *G. flavipes*, and *Sterna frenata;* and as his list includes some that are *resident* here, for instance: *Carthartes aura*, *Geothlypis trichas*, *Vireo* (*barbatulus*) *altiloquus*, *Columba leucocephala*, *Chamœpelia passerina* and *Pandion carolinensis*, I thought I would insert them.

Observations on some Birds seen near Nassau, N. Providence, in the Bahama Islands. By N. B. Moore.

Dr. E. Coues tells us that the *Vireos* are strictly insectivorous birds. This is an error, certainly, in regard to two species seen here — *V. crassirostris* (Bryant) and *V. flavifrons*.[1] How many other species of Vireos are as fond of a diet of this sort, I cannot say — perhaps many.

The number of winter visitors from N. America to the Bahamas is as large, when fully observed, as the number found in Cuba, from the same region. For, adding my list of thirty to the previous list — less one (*Chordeiles popetue*, which I think is not found here), we have a total of 29 + 25 = 54 species, observed in the Bahamas, and a large majority of them on the island of New Providence.

It may be that *Tyrannus dominicensis* should be discarded from the list. I have not seen it here — to identify it.

As to Dr. Bryant's *Chordeiles popetue*, I ought, perhaps, not to assert my opinion against his, for it is scarcely possible that he, a resident of Boston, can be ignorant of the New England "Night-hawk's" coloration, as also of its utterance. But I do think that, as he left here on the 13th of May, and *this* "Pĭra-mĭ-dĭck," as it is called here, only "began to arrive on the 1st of May, though they became numerous by the 10th," he did not hear their notes, which are peculiar — entirely unlike those of *C. popetue*. It utters the word "Pĭra-mĭ-dĭck," both when mounting aloft, and also at the lowest part of the curve, when making its plunge towards the earth, in the same manner as does *C. popetue*. I cannot think that any person who has heard the voices of these birds, could for a moment suppose them to be the same species. Mr. Gosse mistook the Jamaica bird

[1] Mr. Moore's extended observations, showing that both species named feed greedily on the fruit of the Gumbo-limbo tree, are omitted for want of space. All of the family are well known to be largely fruit-eaters. (See North American Birds, Vol. I, pp. 362, 365, 372, 381, etc.)

(there designated by the same vulgar name as here) for *C. popetue*. Dr. Sclater decides [Proc. of Zoological Society of London, 1861, p. 77] that the Jamaican bird of Gosse is *C. minor*, and I presume the one found here by Dr. Bryant is the same.

I here present the dimensions of one killed July 26. Adult, female: — $21\frac{1}{2}$, $8\frac{1}{2}$, wing $7\frac{1}{2}$, tail $3\frac{3}{4}$, cul. $\frac{9}{32}$, width of mouth, $\frac{7}{8}$: weight of this one 2 oz.; of a young one 1 oz. 7 dr.

The white patch on the wing is confined to first quills, and does not reach the shaft on outer quill of the adult; it is nearer the tip of the wing than the carpus by nearly the breadth of the patch. There is no sign of a rudimentary white spot on the fifth quill of this one, but on the other, young, the fifth quill is touched on both sides of the shaft with grayish and light ash mottling; not moulting. Color below, especially on abdomen and crissum, with strong wash of rufus, stomach and throat crammed with a pellet of red winged ants; left Nassau Oct. 25 to 28.

Athene (Spheotyto) cunicularia. Soon after my arrival here, on Oct. 12, I saw on two occasions, in the dusk of evening, small owls, which took to be *Scops asio*. One having been brought me by Mr. Brace, I was not a little surprised to see the same species found in Florida and California.

Its habits here seem quite unlike those noticable in those places. I have but once seen it in daylight; this was a few days ago. I supposed I flushed it in a thicket where the trees, being sometimes clustered, with numerous bare spaces of rock and earth among them, are generally about fifteen feet in height. I saw it perch on the top of one — the very *apex* — as I had seen them, at night, on two previous occasions, and as I have once or twice seen the Florida birds on low bushes in the prairie, in midday, near their burrows.

The young person who killed one says he has seen them in bright daylight. The stomach of one contained a tree (?) frog, and a small crustacean. Their littoral habits on this island, and their residence on the very low region of Florida, together with their western plains habitat, would seem to endow the species with cosmopolitan qualities.

Stryx furcata (?) Dimensions, adult, ♀, 48, $16\frac{5}{8}$, wing 14, tail 6, tarsus $3\frac{11}{16}$, culmen (a long curve) 2, tip of bill to anterior part of nares $1\frac{3}{8}$, gape $1\frac{11}{16}$, depth of bill on middle of nares $\frac{11}{16}$. Moulting — lateral rectrices one-half longer than central ones; the pair next to laterals are three-sixths shorter than third, fourth, or fifth pair, the last three being equal in length.

Certhiola flaveola (bahamensis?). I am surprised to find in Dr. Bryant's description [Proc. Bost. Nat. Hist. Soc., Vol. VII, p. 117] of this species no mention of the rich yellow on edge of carpus, and especially of the conspicuous expanse of the same rich color across the breast and fore belly. I have never seen an adult bird, of either sex, without these marks, here, or at Inagua.

Again, I must correct Dr. Bryant in regard to the "insect" food extracted from what he called "*Verea crenata*," on which they are feeding much at the present time (Feb. 3). There is much delicious nectar within the flower of this plant, of which the Certhiola is very fond, and which he has learned to obtain *by thrusting its bill through the petals*, as Dr. Bryant truly says, at once, into the nectary. Now I have spent much time in examining these flowers, and never, but in one instance, and that of a malformed one, did I find an insect in the nectary *until* it had been penetrated by the bill of the bird; *after* an opening has been made by him, very small black ants, and very small winged insects may be found therein.

On the 17th of Dec., I found a yellow-bellied woodpecker extracting sap, in usual fashion, from a logwood sapling, whose juice is very sweet — quite honey-like. As the *Picus varius* flew away at my approach, two Certhiolæ appeared on the scene, perched near the sap pits, whence the nectarious juice was oozing, and by the cunning use of their pennicillate, or bristly tipped tonges, at once, with amusing audacity, commenced to lap, sip, or suck into their mouths the poachers' share of it. This was on the 17th of Dec., and this intrusion upon the woodpecker's domain has been kept up constantly since that time.

About the 20th of Dec., I made the bowl of a teaspoon fast in a fork of the same tree, three feet below the sap pits, placing some strained honey in it. On the 23d, three days afterward, they found, and at once commenced to feed on this; not, however, till after another pennicillate, or bristle-tongued bird, *Dendrœca tigrina*, had found it, and habitually visited this new fountain. The *D. tigrina* had been seen at the woodpecker's sap pits, on the same day as the others, and has continued to the present day (Feb. 3) to feed at the spoon, latterly on sugar and water for four days. Occasionally at the sap pits I have seen *Dendrœca coronata*, and a species of Anolis has been a regular feeder since the 17th of Dec., both at the sap pits and at my spoon of honey, and sugar and water. Two other woodpeckers of the same species, female and young male, were at times seen to intrude on their brother's banquet.

My opinion is that this bird is, to but small extent, insectivorous; it undoubtedly eats insects sometimes, as does *Dend. tigrina*, whose tongue is of similar structure. It is a bold and unsuspecting fellow; those I am feeding sit within three feet of my hand as I pour their food into their spoon — they know me as their protector.

Certhiola bahamensis, incubating on three eggs, March 16. This species probably nests much earlier, as I saw them copulating Jan. 12, and again later in same month. I think both parents incubate; the male has no song.

Stryx ——— ? marked in the above " *S. furcata?* " I now suspect is *S. pratincola.* The female laid her first egg Feb. 17, the only other one, probably, on the 18th. The two eggs were seen yesterday at 5 P. M. To-day is the twenty-sixth since incubation began. I failed to see them to-day, as the female sat so close, therefore I think the young may be getting out.[1] Only the female sits during the day, as I found to be the fact with *Scops asio*; whether the male sits during part of the night, I cannot determine.

The nest is in a niche in a perpendicular (vertical) wall of rock, thirty feet from the base, and fifteen feet below the top, and is unapproachable. I killed one of a pair of this species, a female, as she entered the niche; the male, her mate, on the following night entered it, uttered his peculiar call note, an owl soon approached, he gave chase, they flew about for some time, and on the next night they were, to all appearance, mated. Had the male been killed instead of the female, this sudden marriage, and particularly *her* continuance at the old nesting place, would seem less surprising.

The eggs, as seen by a good spy-glass at about forty feet, appear pure white, and a very plump, or shortish oval, or scarcely round-globular. The eyrie was never occupied by day till the first egg was laid, since the laying of which the female has not left during the day. The first egg was deposited between the hours of 11 and 1.30, near the middle of the day.

This species has two very distinct vocal utterances; one a "call note," a sort of low rapid chattering or clacking, uttered, so far as I have observed, when perched. The other a monosyllabic note, which I would spell "creech," uttered in a harsh, half scream, while on the wing, the intervals being very long.

Of their food, and manner of feeding, I cannot speak.

[1] March 19. The two eggs were as yet unhatched, and must of course be addled; therefore I cannot state the period of incubation of this species, which I had hoped to do. The female still occupies the eyrie.

Cyanospiza ciris, one, a male, in splendid dress; seen Feb. 9.

Mimus polyglottus (?), ♀, killed Feb. 28, only one seen.

Vireosylvia olivacea (?), ♀, killed March 15, only one seen in the Bahamas by me. This bird was seen by me only on two mornings (March 14 and 15), uttered no note, was feeding on gumbo-limbo berries with *V. crassirostris* (Bryant), where the latter have fed daily since December.

Polioptila cœrulea, only one seen on this island, March 18.

Section of Botany. May 23, 1877.

Mr. R. W. Greenleaf in the chair. Seventeen persons present.

Mr. B. D. Halsted described the climbing mechanism of the Japanese Ampelopsis, arriving at four conclusions:

1. The clinging disks terminate tendrils which are homologous with main stems.
2. While approaching a support, these disks flatten themselves on the inner side.
3. The surface of the disk is papillose and excretes a sticky substance.
4. The irregular contraction of the tendril draws the vine to its support.

Dr. W. G. Farlow exhibited a specimen of a fungus parasitic on birch catkins.

Dr. G. L. Goodale sent six species of Violets for exhibition.

Dr. Farlow stated that Mayflowers had been found at two localities within six miles of Boston.

Section of Entomology. May 23, 1877.

Mr. E. P. Austin in the chair. Seven persons present.

The following paper was read: —

An Insect Wing of extreme Simplicity from the Coal-formation. By Samuel H. Scudder.

At the last general meeting of the Society, the wing of a fossil cockroach from Pennsylvania was exhibited; in consequence of which Dr. Packard sent me a fragment of anthracite shale preserved in the Museum of the Peabody Academy of Science at Salem, bearing certain impressions. The specimen was taken from a coal hod in New York City by Mr. James Angus of West Farms, and is supposed to have originated from Pennsylvania.

Upon this piece of carbonaceous shale is the well defined wing of an insect of marked simplicity. It is small, and very broad in proportion to its length, with a costal margin very much arched apically, a pointed subfalcate tip and an anal region broadly lobed. The number of principal veins is six, arranged to a certain extent by pairs, since each pair approximates to a greater or less extent at the extreme base. I have long maintained that the normal number of veins in the wings of insects is six (as upheld by Heer and others), and that they were arranged by pairs; but that in many insects one or another, or indeed most of the veins, might become aborted, and that they become differentiated in the various groups in different ways, sometimes one and sometimes others playing the principal role, and one or more, although not always the same, being quite simple, while others by branching support the principal part of the framework of the wing. In this ancient wing, however, scarcely the slightest differentiation has begun, each of the veins branching near the base, again with slight diversities before the middle of the wing, and again either (in the upper half) at, or (in the lower half) beyond the middle of the wing; there are also occasional additional branches; but each principal vein appears to branch to an almost exactly equal extent; the region covered by the uppermost pair of principal veins and their branches, however, exceed that covered by either of the other pairs; it is indeed about equal to the other two combined, which share equally between them the lower half of the wing. The general resemblance of the whole to the distribution of the tracheæ in the forming wing of a caterpillar is very striking; and if the theory of the wing that I have maintained be correct, this is precisely the number and mode of distribution of the veins which one would predicate for the primæval wing. Hitherto we have arrived at nothing of the sort; in all the wings we have yet seen from the Carboniferous or Devonian formation, differentiation of the veins has already reached nearly or quite the same degree of perfection as in living insects; excepting, possibly, in some cases where, from the fragmentary nature of the remains, it is impossible really to say what degree of uniformity or simplicity the different veins possessed.

In the third volume of the Geology of Illinois, I described several species of obscure carboniferous remains of wings under the generic name Euephemerites. They were so fragmentary that little could be said concerning them, and unfortunately the engravings gave no sort of idea of the structure that could be seen. It is interesting now to find that this wing is so closely related to them that it should be placed in the same genus, though separable specifically from them in the delicate and equal striation of the entire surface parallel to the veins, in the more frequent and apparently more regular branching, and in the considerably smaller size. In none of the former species could the shape of the wing be determined, while this is quite perfect. The species may be called *Euephemerites primordialis*. The length of the wing is 11.5, its extreme breadth 6.75. It may be added that a fragment of an exceedingly slender, straight, perfectly simple, cylindrical and unarmed leg crosses a part of the wing, broken at intervals, but altogether about 7 mm. long. A figure of this species, as well as new figures of the other species of Euephemerites will be given in a future memoir on the Carboniferous Insects of America, for which I have long been gathering material.

Upon the same shale is a specimen of Cyclopteris which Professor Lesquereux has determined as *C. elegans* Lesq., or *C. hirsuta* Lesq., the specification being doubtful, as most of the borders of the leaflet are destroyed. Mr. Lesquereux thinks the shale is undoubtedly from the coal measures of Pennsylvania.

Mr. S. H. Scudder stated that he had detected *Pieris rapæ* in the act of laying eggs on *Nasturtium palustre*.

Mr. Scudder also exhibited a drawing of a wing of a fossil insect from the Tertiary bed of White River, the neuration of which did not entirely agree with that of any wing known to him, although it presented great similarity to that of a Tipulid. It was subsequently described as an abnormal Tipulid under the generic name Cyttaromyia.[1]

[1] Bull. U. S. Geol. Surv. Terr., III, 751.

Section of Entomology. June 20, 1877.

Mr. E. P. Austin in the chair. Eight persons present.

Mr. J. H. Emerton said that, in company with Mr. Austin, he had been on Mt. Washington from June 2d to the 18th, collecting the early insects.

On account of unusually warm weather the season was too far advanced in the Glen and about the lower part of the mountain, but at Hermit Lake and near the Half-way House the snow had just melted, and a great part of the insects were still in their winter hiding places. Much time was spent in sifting moss along the Hermit Lake path, the camp near the Half-way House, and as far up as the highest trees on the mountain, about the same insects being found at all these places.

Mr. Emerton found *Epeira Packardii* abundant all over the eastern side of the mountain down to the trees. Males and females were seen together in the webs, the males standing near the upper edge.

Along the lower part of the carriage road *Epeira displicata* was found in webs not more than six or eight centimetres in diameter among the leaves at the ends of branches of low plants.

About two hundred species of spiders were collected, chiefly from the siftings from moss.

Between the Glen and Gorham, *Nymphalis Arthemis* was seen flying June 18th.

Mr. Scudder remarked that this butterfly had not been out more than three days. They get ragged in a few days. For three years he had found them emerging between June 16 and 20.

Mr. E. P. Austin said there was a great flight of insects on the summit of Mt. Washington while he was there (second week of June, 1877).

The willow Galeruca (*G. decora*) was very abundant this year, millions were to be found on the dwarf willows high up on the mountain, the walls of the hotel and the platform being covered sometimes in piles; undoubtedly millions were present; nineteen-twentieths of all the insects at the summit were of this one species.

Above the timber line (near Willis's seat) he found twenty-five *Carabus Chamissonis* in one day, by turning over several hundred stones between 9 A.M. and sometime after 3 P.M. He found also a number of *Pterostichus punctatissimus* in the subalpine region at the place which is called the "silver forest," where the road turns at the point of the Ledge. This region has been burnt over and its character has been changed thereby. The trees do not show an inclination to grow, where the spruces grew formerly, even birches have hardly begun to start.

General Meeting. October 3, 1877.

The President, Mr. T. T. Bouvé, in the chair. Twenty-four persons present.

The following papers were read: —

On the so-called Tremolite of Newbury, Mass. By M. Edward Wadsworth.

The first notice of this mineral that I find is in Cleaveland's Mineralogy published in 1816, in which tremolite is said to occur "in Newbury, not two miles from Newburyport, and near the turnpike, in fibrous radiated masses with granular limestone, serpentine, asbestos, garnet, etc." Robinson, in his "Catalogue of American Minerals" (1825), quotes from Cleaveland and makes the same statement. Hitchcock, in his reports on the Geology of Massachusetts, also speaks of the occurrence of tremolite at Newbury, and by the associated minerals, he, as well as Cleaveland, shows that he refers to the well known locality in Newbury called "Devil's Den."

My attention was first called to this mineral by some specimens presented to me by Mr. W. L. Titus, a student in Harvard College.

From its general resemblance to specimens of Wollastonite in the mineral cabinet of Harvard College, particularly those from Tausa, Sweden, which were received from Professor Angelo Sismonda, I was led to believe that it was that mineral and not tremolite.

It agrees with Wollastonite in cleavage, quiet fusion, and gelatinization with hydrochloric acid, and, moreover, chemical analysis proves that it is a silicate of lime (Wollastonite) instead of a silicate of lime and magnesia (tremolite), as it yields even in concentrated solutions only traces of magnesia; all of which conclusively shows that it is the former and not the latter mineral.

Notes on the Occurrence of Micropalama himantopus in New England. By Dr. T. M. Brewer.

The specimen of Stilt Sandpiper, presented by Mr. Geo. H. Mackay, besides being a valuable donation to the Society's collection of New England birds, derives an added interest from the fact that it is, without doubt, the first specimen known to have been taken in Massachusetts, or in any of the New England States. It was shot by Mr. Mackay on the edge of Farmer's pond, near Phillips Beach, Swampscot, in August, 1857 or 1858, probably the latter year. It was, even then, a bird not unknown to the Phillips family, and called by them the "Cross," being supposed to be a hybrid between the Summer Yellow-leg (*Gambetta flavipes*) and the Spotted Tatler (*Tryngoides macularius*). They spoke of it as of rare and irregular occurrence, coming singly or in pairs, and usually in company with the *G. flavipes*.

Two or three years later, probably in 1860, Mr. Mackay was informed by the younger Mr. Phillips that there had occurred in August of that year, and in the same locality, a very remarkable flight of this bird, during which nearly two hundred individuals had been secured by members of the Phillips family and sent to market. Although Mr. Mackay has hunted nearly or quite every summer, and about the same time in this vicinity, he has never met with another of this species.

Dr. Coues, in his catalogue of the Birds of New England, in 1868, refers to it as a bird he confidently expected would occur, but he was not able to refer to any recorded instance of its capture, no public mention of Mr. Mackay's specimen having then been made, though it had then been ten years in the collection of that gentleman. Mr. Maynard, as recently as 1870, refers to this bird as "very rare — a single specimen captured in autumn by Mr. Wm. Brewster, at Rye Beach, N. H." In a foot-note, Mr. Maynard refers to another taken at the same place August, 1869.

In the 6th volume of the Am. Naturalist (1873, p. 307), Mr. Wm. Brewster regards this species as by no means rare during its migrations, and adds that he has seen as many as six or seven sent into Boston market at one time, said to have been shot on Cape Cod.

In a letter from this careful and observing naturalist, written in July last, he informs me that he has shot, in all, about twenty specimens, and has usually found them associated with *G. flavipes*, but never, so far as he can recall, with *G. melanoleucus*. He has often seen and shot solitary individuals, and several times has had a pair come in together to his decoys. He is confident that he has received specimens said to have come from all parts of Cape Cod, and adds that most of the gunners at Chatham profess to know this bird well, and to have shot it frequently. Mr. Brewster has seen bunches of six sent in to the Quincy market unmixed with any other species, from which he naturally infers that they were all shot at one time, and probably from one flock. I hear from other quarters of gunners on the Cape who claim to have shot this bird, but so far I am without any tangible positive proof of the correctness of this claim, such as the identity of the bird, the time, place and witness.

In August, 1872, I was witness to the capture of two specimens among the Elizabeth Islands. Each bird was shot in a flock of *Gambetta flavipes*, and was without any companion of its kind. In each instance it was a new bird to the gunner who procured it. In a majority of instances it is unfamiliar to experienced gunners to whom I have shown specimens.

Mr. O. Fuller (Naturalist, v, 727) refers to a single specimen taken at Needham, Mass., July 24th, 1871, in company with a solitary sandpiper.

Mr. R. L. Newcomb of Salem, a good ornithologist and a diligent collector, has kindly furnished me with interesting memoranda of his observations relative to this bird in Massachusetts. He has never met with this species in the spring, nor is he aware of its having ever been taken prior to August 4th. During the spring of 1873, he spent seven weeks about Ipswich, Plum Island and Rowley, but he neither saw nor heard of a single individual of this species. He has collected in Maine, during the months of August and Sept., 1874, but never met with this bird. He has never met with it in flocks (except of other species; in such cases generally the Yellow-leg), for the most part singly, twice only in couples. I add a summary of Mr. Newcomb's memoranda:

"I have collected since Oct. 21st, 1869, but did not meet with this species until 1871.

"No. 1. Juniper Pond, Salem Neck, Aug. 4, 1871. A fine male bird in thin flesh, which had been previously crippled in its right leg.

This bird I flushed, like a snipe, from some short thick grass on the edge of this pond-hole. I regard my meeting with it there as purely accidental, and only owing to its disabled condition.

"No. 2. 'Eagle Hill Slough,' a regular salt marsh, on Ipswich Great Neck, Plum Island River side, Sept. 8, 1871, alone, sex not ascertained.

"No. 3. Same locality, alone, though I obtained a variety of other waders during the day. Sex not noted, August 12, 1872. This species is not considered rare by Ipswich gunners, most of whom take a few every fall. It is known with them as the Bastard Yellow-leg, though its legs are black. I also saw two shot by a market gunner, same place and season. I spent nine weeks that autumn at Ipswich, and made notes of the rare birds.

"No. 4. Same locality, a solitary bird, sex not ascertained, Sept. 18, 1873.

"No. 5. Swampscott Slough, or Farmer's Pond, a slough pond, mostly fresh water, near Phillip's Beach; alone, ♀, Sept. 29, 1874.

"No. 6. Same locality as No. 5, alone, male taken in 1875. This specimen is mounted and in the collection of Mr. A. F. Gray, Danversport, who has full data.

"No. 7. Same locality, Aug. 23, 1876. There were two, being the second time I have seen them other than singly.

"No. 8. Same locality, alone, sex not noted."

Within a few days I have received very interesting additional information from Mr. Newcomb, and I quote from his letter of August 27. "I beg leave to call your attention to what appears to be the increasing occurrence of the *M. himantopus* in this vicinity (Salem), or rather county, particularly at Eagle Hill, Ipswich. A friend of mine, during the latter part of July, the 30th I think, while gunning at Ipswich, shot seven out of a flock that came into his decoys. I purchased three fine specimens. There were said to be about a dozen in this flock. I have never met with more than two at any one time together, but I have no reason to doubt my friend, who is Mr. Andrew O. Gardner. Another friend, Mr. Daniel B. Webster, shot one at Swampscott on the 8th of August. All these specimens in both instances were males. I think that later in the season there would have been females, as both in spring and fall, with shore birds, and indeed many other classes, the males migrate first. Certainly, in the fall the females and the young come after the males."

Mr. George A. Boardman, who for many years past, both in the spring and in the autumn, has diligently hunted on the coast and estuaries of eastern Maine, has sought for this bird, but has never met with it, and all his enquiries have satisfied him that it is unknown to that region. None of the hunters or gunners know the bird. As the marshes in the vicinity of St. Andrew are regarded as among the finest hunting-places for shore-birds on our coast, and as these have been thoroughly searched in vain, it would seem to be established as far as negative testimony can ever establish anything, that this bird does not occur in the waters of eastern Maine or New Brunswick.

Nearer the centre of the coast of Maine, at Schooner Head, Mt. Desert, a small colony of young hunters have, for four summers, kept a sharp look out for this bird. In its search they have ransacked the beaches and marshes of the head of Frenchman's Bay, in Sullivan, Gouldsboro, and elsewhere. They have carefully preserved specimens of all the birds they could procure. But this species has never been seen or heard of by them on that part of the coast.

Mr. Frank L. Tileston (Tileston & Hollingsworth) and Mr. Wm. Everett (Williams & Everett), both enthusiastic and active sportsmen, have for many years hunted shore birds on various parts of the New England coast, usually in company, on the north shore, or the south shore, and in various parts of Cape Cod. More recently they have explored the coast of Prince Edwards Island. Mr. Tileston, though he knows the bird, has never yet met with a single specimen. Mr. Everett has met with it in Ipswich and in different parts of Cape Ann, but no where else. In one instance he fired into a flock, about half and half, *flavipes* and this species, shooting three of the latter, one of which he has in his collection of shore birds. He thinks there may have been twelve of each kind in the flock. But on Cape Cod, in Orleans, Dennis, Yarmouth, Chatham, Truro, and other towns, he has not only never met with this bird but has been unable to satisfy himself that it has ever been taken by any other gunner. For the most part the gunners do not know the bird, and have never seen it, and wherever any one has claimed to have shot something similar, the evidence has always been vague and unsatisfactory. In Prince Edwards Island the bird is wholly unknown. Neither Mr. Tileston nor Mr. Everett met with it, nor could they ascertain that it had been known ever to occur there.

Mr. Henry D. Morse, of this city, an experienced gunner and observing sportsman, has occasionally met with single specimens of this species in Scarboro, Maine, but has observed none anywhere else, but more recently one or two others have been secured in the neighborhood of Portland.

The only specimen of which I have any knowledge, taken on Cape Cod, is a single individual shot by Mr. John Murdock, at Pochet Island, Orleans, on the south side of the Cape, in August, 1869. It was in a mixed flock of *G. flavipes* and *Macroramphus griseus*, but unfortunately was not preserved, so that its identity, though probable, is not so certain as could be wished.

These data are all too meagre to be accepted as conclusive of anything. They are chiefly negative, but so far as they go they indicate that this species is not a regular migrant, in the proper acceptance of the term. It does not occur along our coast in the spring, and is only occasionally and very irregularly met with on a small portion of our extended coast in the fall, and even then it comes more as an uncommon straggler than like a bird fulfilling its normal migrations. In only one or two instances has it been known to come in flocks, or even in family groups, but chiefly appears as if wandering off in company with non-kindred species. There are only one or two instances of its occurrence east of Portsmouth, none east of Portland, and none west of New Bedford, on the coasts of Rhode Island and Connecticut. The few that straggle along the western coast of Maine, that of New Hampshire and of northern Massachusetts, evidently come from the north and not the east, in a due-south course, and probably pursue this course, leaving the shore at Buzzard's Bay, over the open sea. In this southern course its earliest recorded capture is July 24th, and its latest Sept. 29th. This remarkable variation as to the period of its appearance, is alone demonstrative evidence of the great irregularity of its movements, wholly at variance with the common idea of a regular migrating bird.

The thanks of the Society were voted to Mr. Mackay for the specimen of Sandpiper referred to.

General Meeting. October 17, 1877.

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

After calling the meeting to order, Mr. Scudder announced the death of Mr. John G. Anthony, of the Museum of Comparative Zoology, for thirty-three years a member of the Society, and well known as a conchologist.

Mr. C. S. Minot gave an account of some recent investigations which he had made on the physiology of muscles.

Dr. T. M. Brewer called attention to a fine male specimen of *Plectrophanes lapponicus*, the Lapland Longspur, in spring plumage, obtained May 1, 1877, in Swampscott, and purchased for the New England Collection.

This bird is rare in New England, and especially so in both its mature and spring plumage. In the west its occurrence in full plumage, though more common, is still somewhat unfrequent.

A letter from Mr. Alex. Agassiz, Chairman of the Committee on Walker Prizes, was read, recommending that the prize for 1877 be awarded to Prof. C. V. Riley, for his essay on the "Army Worm and its Parasites." No essay was presented in competition.

General Meeting. November 7, 1877.

Vice President, Mr. S. H. Scudder, in the chair. Fifty persons present.

The following candidates for Associate Membership were elected: Messrs W. B. Barrows, Chas. F. Batchelder, Albert Conant, Frederick Habirshaw, W. A. Stearns, B. H. Van Vleck, and Mrs. Edw. Whitney.

Dr. B. J. Jeffries called the attention of the Society to the renewed attempt to open Jourdain's Gallery of Anatomy, and offered a resolution petitioning the City Council to withhold a license.

Dr. H. W. Williams seconded the motion of Dr. Jeffries, stating his reasons for hoping that the resolution would be passed by the Society.

Dr. Jeffries then gave at length the history of the so-called Gallery of Anatomy, describing the character of the exhibition and its harmful influence on the morals and health of the city; in concluding he apologized for bringing the matter before the Society, but he believed the public should be thoroughly awakened to the nature of such exhibitions.

The resolution was then put to vote and passed unanimously.

Dr. Carl Semper, of Würzburg, gave an account of the anatomy and habits of Onchidium, a genus of littoral molluscs which he had studied in the Philippine Islands.

The thanks of the Society were voted to Mr. G. O. Welch, of Lynn, for his gift of the Lapland Longspur, exhibited at the last meeting.

General Meeting. November 21, 1877.

Vice President, Mr. S. H. Scudder, in the chair. Twenty-nine persons present.

Mr. S. W. Garman read a paper on some features of erosion in the Temperate Zone.

Mr. C. S. Minot made some remarks on recent German investigations on the development of Lepidoptera, Bryozoa and Crustacea, which seemed to confirm his views of the significance and growth of the primitive germinal layer.

Letters were read from Prof. Carl Zittel, acknowledging his election as Corresponding Member; and from Prof. A. v. Kölliker, Sir J. D. Hooker and Mr. George Bentham, acknowledging their election and accepting Honorary Membership.

Dr. T. M. Brewer exhibited a number of additions to the New England collection of birds, including gifts from Messrs. E. A. and O. Bangs, C. B. Corey, F. R. Loring and Wm. B. Greene; also a young Blue Heron (*Florida cærulea*), in white plumage, procured by exchange from Mr. Morse, who shot it in Cohasset twenty-five years ago; and a duck (*Dendrocygna fulva*), an inhabitant of W. Indies and C. America, obtained by Mr. Morse in San Francisco. The thanks of the Society were voted to the first mentioned gentlemen for their gifts.

General Meeting. December 5, 1877.

The President, Mr. T. T. Bouvé, in the chair. Twenty-one persons present.

Mr. S. H. Scudder showed some drawings of interesting Articulates from the carboniferous rocks of Illinois. The first represented a species of White Ant, showing a wing without reticulation; the second the terminal segments of a crustacean belonging to a genus allied to *Dithyrocharis*; but which he had at first taken for some extraordinary form of insect.

Prof. A. Hyatt discussed the evolution of the races of *Planorbis multiformis*, a species of mollusk from a tertiary lake bed at Steinheim, in the Würtemburg Alps.

A letter from Prof. Albert Gaudry acknowledging his election as Corresponding Member was read.

Dr. T. M. Brewer announced the donation, for the New England collection, of six mounted species of birds, the gift of Mr. Wm. Brewster of Cambridge, and of eight mounted specimens from Mr. Arthur Smith of Brookline, for which the thanks of the Society were voted. Dr. Brewer mentioned that he had also procured an interesting specimen for the same department from Mr. Welch, of Lynn. It was pronounced by Prof. Baird and Mr. Ridgway to be an immature *Ammodramus maritimus*, in the plumage regarded by Audubon as a distinct species, and called by him MacGillivray's Finch. This restores the species to Massachusetts, in which its presence has been denied. The individual in question was shot at Nahant.

At the desire of the President, Dr. Brewer gave a brief account of his observations relative to the Sulphur-crested caterpillar (*Orgyia leucostigma*), and the circumstances under which it is devoured by the House Sparrow.

In the summer of 1868 and 1869, these insects had become exceptionally abundant in the city generally, and especially on the Common. In the winter of 1870–71, having occasion to cross the Common several times in the day, he noticed numbers of the sparrows, though then comparatively few, busily engaged in the destruction of the cocoons. This was continued through the winter, and again in the following winter, and was observed by others besides himself. In 1874 he published, in the " Sportsman," an account of his observations, having no doubt that the total disappearance of this insect from the Common, and from all of the city south of the Common, was directly owing to the intervention of the sparrow. A gentleman in New York, in a private letter, questioned the accuracy of his conclusions, because in certain streets of that city this caterpillar remained, in spite of the sparrow, and Dr. Oliver also called his attention to its presence in Joy Street, in Boston. How to explain these apparent incongruities, was not at first possible, and the two following summers he was in Europe. The present summer a writer in the "Advertiser" called attention to the abundance of this insect on the Common as evidence that the sparrows can not be depended upon for their destruction. Here were their cocoons all about and untouched. Dr. Brewer was absent from the city at the time, and could not renew his investigations until September. Previous, however, to his leaving the city, he had noticed swarms of these caterpillars in Charles and other streets, moving in the direction of the common, which on the 10th of July had been green, fresh and uneaten, no insect anywhere even visible. On his return he satisfied himself that the matter had been greatly over-stated. A careful and very thorough examination of all the trees showed the presence of less than a hundred cocoons, and all of these were on a narrow strip north of the path from Spruce to Winter Street. These gradually disappeared, but he did not see how. After the heavy frost and rains preceding Nov. 5th, most of the trees became leafless, and on a few small linden trees near Spruce Street were observed several clusters of these cocoons, and all these trees were swarming with sparrows, eagerly devouring them. The leaves of these trees were whole and uneaten. The same thing was observed on the 8th, and then the whole incongruity was explained by the experienced and observing policeman in charge of that part of the Common, Mr. T. H. Peabody. The caterpillar itself is never eaten; is hairy coat makes it offensive or unattractive. The female moth is wingless, and issues from her cocoon for a life only long enough to deposit her eggs, which she protects by a viscid, frothy substance that hardens into a horn-like cover. In a dry condition this is impenetrable. It can neither be torn from its place of adhesion, nor be opened. It requires long and soaking rains to render it soft and pliable, and in that condition it is readily eaten. Nearly all the cocoons have now been removed, and only here and there, under the shelter of some large limb, remain to demonstrate the interesting explanation.

Dr. Hagen, of Cambridge, commenting on these observations, stated that during the ten years he had resided in Cambridge, he had been much interested in the presence there of our singing birds. During the summer just passed he had particularly noticed their unusual abundance. The sparrows, too, were there in great numbers; wherever the singing birds were there were sparrows also, and the latter certainly had not in any manner lessened the numbers of the former. He thought that Dr. Coues, in his recent communication published in the "Advertiser," was wrong, and his own observations convince him that the sparrows do not interfere with, or drive away our singing birds.

Dr. Brewer stated that his observations in Boston were to the same effect. For fifty years he had been a close observer of the birds on the Common, and in no season had he known so large a number, or so large a variety, as during the past summer. He and some of his younger friends were keeping a careful record of the species that summer on the Common, which would be make public. Mr. Peabody, the officer referred to, assured him that he had repeatedly seen a large number of our native birds bathing with the sparrows, in the fountain near Park Street, and had never seen one of them molested by the latter.

The following paper was presented by title: —

On the Pyralid Genus Epipaschia of Clemens, and Allied Forms.

By A. R. Grote.

The genus *Epipaschia*, which I have excluded from the Noctuidæ to which it is referred (Herminidæ) by Clemens (Proc. Ac. Nat. Sci. Phil., 1860, p. 14), is characterized by a peculiar tegumentary scaled process which arises from the base of the male antennæ, and is thrown backward over the thorax, which it nearly equals in length. Dr. Clemens does not give this appendage as a sexual feature, but it is wanting in the females; this author also calls it *articulated*, but I can detect no suture.

Lederer, in his monograph of the group, establishes two genera signalized by a corresponding character, *Deuterollyta* (p. 358) and *Homura* (p. 339). The last need not detain us for it is founded on a Sicilian species without ocelli, which are present in the species of *Epipaschia*. Whether Lederer's *Deuterollyta conspicualis* from Brazil really belongs to this genus of ours I am exceedingly doubtful. A specimen of *Epipaschia superatalis* has been determined by Prof. Zeller as Lederer's species, but it cannot be the same, judging from Lederer's figures. Lederer says of the antennal appendage: "die männlichen Fühler mit langen dünnen büschelweise gestellten Wimpern; hinten ihnen ein grösser über den Rücken zurück gebogener, Palpen nicht unähnlicher zweitheiliger Haarkamm" (p. 359). But in Epipaschia it is a scaled tegumentary process, cylindrical in shape. The Brazilian species differs also in color and markings from *superatalis*.

A careful examination satisfies me that this process moves with the basal articulation of the antenna. In a second North American species, referred to Zeller's genus *Mochlocera*, the same structure may be observed; the process is a little shorter and more densely scaled, especially at the tip.

Epipaschia Clemens.

Ocelli present. Labial palpi pointed, exceeding the front. Male antennæ with the joints beneath provided with bunches of moderately short hair, and with a scaled tegumentary process arising from the basal antennal joint and thrown backward over the thorax. Fore wings twelve-veined; 5 running very close to 4, joining it by a very short cross vein just without the inception of 4; 6 from 7 at extremity of cell; 7 to external margin before apex; 8 out of 7 to costa just beyond apex; 9 out of 8 a short furcation (difficult to see in my specimens) to costa; 10 just before the extremity of cell; 11 beyond the middle of the upper margin of the cell. At base vein 1 is furcate. Hind wings eight-veined; 8 free; cell open; 5 near to 4.

Epipaschia superatalis Clemens, Proc. Ac. Nat. Sci. Phil., 14, 1860.

Deuterollyta borealis Grote, Bull. Buff. Soc. Nat. Sci., 1, 177.

♂, ♀. Fore wings dusty yellowish gray with powdery black lines. Inner middle line marked on costa by a black dot; below it is obsolete, or partially indicated. A black discal dot near the costal spot of the inner line. Outer line irregularly denticulate, better marked superiorly where it runs obliquely outwards to median nervules, produced about vein 4, thence running inwardly below vein 3, whence it descends, very slightly outwardly, projected, to internal margin. Terminal field wide; a diffuse, broad, brownish or blackish shade band, marking the veins. A terminal series of distinct interspaceal black marks becoming continuous inferiorly. Fringes pale, interrupted with brown and with a dotted line. Hind wings fuscous, the veins darker marked; a discal dot very near the base and costal border; a terminal distinct line; fringes pale, with a dotted brown line. Beneath yellowish gray, sometimes suffused with blackish; a common line and discal dots; the terminal shade on fore wings less prominent than above, and here also continued on secondaries. Several specimens examined from Oldtown, Maine, Mr. Charles Fish; the type of *borealis* was from Cambridge, Mass., Mr. J. C. Merrill. Dr. Clemens' type was from Farmington, Conn., Mr. Edw. Norton. The average expanse of my specimens is about 22 mill.

Cacozelia n. g.

Ocelli present. Labial palpi pointed, exceeding the front. Male maxillary palpi, scaled, untufted. Male antennæ, ciliate beneath, with a tegumentary basal process exceeding the collar. Fore wings 12-veined; 8 out of 7 at the middle of 7, nearer to the origin of 9 than in Epipaschia; 4 and 5 joining at base; 1 furcate. Hind wings 8-veined; 4 and 5 joining at base. On both wings the cell is incompletely closed.

Cacozelia basiochrealis n. s.

Base of fore wings bright ochraceous, shading to brown on costa and to the double fine arcuate interior line. Median space washed with gray; a brown costal dot. Costa washed with ochreous above the fine oblique exterior line. Exterior line filled in with whitish, followed by a rusty brown terminal shading. Terminally the wing is again washed with stone gray. Hind wings yellowish gray, with a fine denticulate exterior line and terminal dotted line. Beneath ochreous, costa at base brown. Head and appendages ochreous; beneath the fore and middle tibiæ are purplish. Hind legs dotted with brown. Antennæ less strongly ciliate than in *breviornatalis*.

Expanse 18 mill. Two specimens, No. 618, July 17, collected in Texas by Belfrage.

Mochlocera Zeller.

Ocelli present. Labial palpi exceeding the front. Male maxillary palpi scaled, untufted. Male antennæ ciliate beneath, with a basal tegumentary process as long as the thorax. Fore wings 12-veined; 8 out of 7 one third from base; 4 and 5 together at base; cell open. Hind wings 8-veined; 4 and 5 joining; cell partly closed by a prolongation of 5. Vein 1 of primaries simple.

Mochlocera Zelleri Grote.

Mochlocera Zelleri Grote, Can. Ent., 8, 157.

♂, ♀. Fore wings divided into three fields by the median lines. Inner line defining outwardly the blackish basal space; the line itself is black, with a slight median notch, nearly perpendicular. Median space washed anteriorly with white. A short, black, discal streak. Outer black line very finely denticulate, shaped much as in *superatalis*, but not produced so much on median nervules. It arises at about apical third, at first outwardly oblique, then running inwardly below median vein and narrowing the median space thence to internal margin. Terminally the wing is again black or blackish. A broken black line at the margin. Fringes on both wings dark, pale at base, with broken blackish interline. Beneath blackish, with common shade band and black discal point on hind wings.

Expanse 25 mill. Texas, No. 420, collected by Belfrage, April 30. Missouri, collected by Mr. Riley, who informs me the larva lives on *Toxicodendron*.

Toripalpus n. g.

Ocelli present. Labial palpi very long, much exceeding the front; the second elongate joint conceals in the male the bi-tufted maxillary palpus as in Tetralopha. Fore wings 12-veined; 8 out of 7 at the middle of the vein; 4 and 5 connected at base by a short cross-vein. Hind wings 8-veined, 4 and 5 joined together. On fore wings the cell is incompletely, on hind wings almost entirely, closed. In Tetralopha, the primaries are 11-veined and of a very distinct structure.

Toripalpus breviornatalis n. s.

♂. Two specimens; one, the type, perfectly fresh, collected by Belfrage in Texas (No. 421) April 5; the other, larger, from Colorado, sent me by Dr. Bailey, in broken condition, belong to a new species characterized by the antennal appendages being extremely short, hardly exceeding the collar. The labial palpi are longer, and the antennæ have much longer ciliæ than its allies. The ornamentation, but not the color, is like that of *Zelleri.* Fore wings reddish brown at base to the inner line, which is dark brown preceded by a dark shade with raised scales on costa, and submedially slightly produced outwardly. Inner portion of median space washed with white on costal region and anteriorly. A discal dot. The outer line is dark brown, denticulate, produced over median nervules, whence it runs obliquely inwardly to internal margin. It is followed by a whitish corresponding shade line. Terminal space washed with brown, becoming whitish before the margin. The outer line is situated much nearer the outer margin than in *Zelleri.* A terminal dotted line distinct on hind wings. These latter are pale fuscous, with an outer dentate line followed by a white shade more or less noticeable. Terminal palpal joint marked with black, tipped with pale. Head and appendages reddish brown; thorax becoming pale behind. Beneath the wings are reddish brown, becoming paler inferiorly. A common exterior line near the margin and corresponding with the exterior lines on upper surface in shape. Fringes pale, obsoletely interlined. On hind wings beneath a discal point. The Texan specimen expands 24 mill. The ♂ from Colorado nearly 30 mill.

General Meeting. December 19, 1877.

The President, Mr. T. T. Bouvé, in the chair. Twenty-six persons present.

Professor Edward S. Morse communicated some of the results of his work in Japan. His main object in visiting Japan was to study more fully a group of animals upon which he has been at work for a long time — the Brachiopoda.

Having accepted an appointment as Professor of Zoology in the Imperial University of Tokio, he established a Zoological station on the coast for the purpose of collecting material for the University Museum, and for the training of Japanese assistants in the work.

His studies of Lingula have brought out many points new to science. The discovery of auditory capsules in the class of Brachiopods, is one of the most important. These organs he determined in a species of Lingula, and their position and general appearance recall the auditory capsules as figured by Claparède in certain tubicolous Annelids. He has also cleared up many of the obscure points in regard to the circulation, and is prepared to maintain the absence of anything like a pulsatory organ, the circulation being entirely due to ciliary action. Mr. Morse also described some of the habits of Lingula. While partially buried in the sand, the anterior border of the pallial membranes contract in such a way as to leave three large oval openings, one in the centre, and one on each side. The bristles, which are quite long in this region of the animal, arrange themselves in such a way as to continue these openings into funnels and entangle the mucus which escapes from the animal; these funnels have firm walls. A continual current is seen passing down the side funnels and escaping by the central one.

They bury themselves very quickly in the sand, and the peduncle agglutinates a sand tube. They attach themselves by means of this tube to the bottom of dishes in which they are confined.

Mr. Morse exhibited living specimens of Lingula which he had brought from Japan in a small glass jar. The water had only been changed twice since August 20th, and yet no specimen had died. This illustrated the vitality of Lingula more fully even than the experiments he had made on the North Carolina Lingula several years since.

A description was also given of an ancient shell mound discovered by Professor Morse at Omori, near Tokio, and photographs of many of the vessels exhumed were exhibited. The general aspects of the deposit were like those described by Steenstrup in Denmark, and by Wyman, Putnam and others, on the United States Coast. The implements were mostly horn. Only three rude stone implements were discovered. The pottery was remarkable in showing a great variety of ornamentation, though it was very rude in character and did not show the finish seen in ancient Corean pottery, which is found in the Empire. In the incised character of the markings, it recalls the pottery of the east coast of the United States. In the character of the raised knobs for handles on the edge of the vessels, it shows the closest resemblance to pottery discovered by Professor Hartt in Brazil. Mr. Morse was not prepared to say whether it was the work of early Ainos, or a race which preceded them, and which the Ainos displaced in their occupation of the island from the north.

Prof. F. W. Putnam spoke of the great interest of Mr. Morse's observations, and sketched briefly the general character of shell heaps.

Section of Entomology. December 26, 1877.

Mr. E. P. Austin in the chair. Eight persons present.

Dr. Hagen read the following communications:—

Notes on the Tree Nests of Termites in Jamaica. By Henry G. Hubbard.

The tree nests of several species of Termites are very abundant in the island of Jamaica. They are dark brown, more or less spherical or conical masses, looking externally as if composed of loamy earth, and varying from the size of one's fist to huge globes as big as a hogshead. Everywhere throughout the island they form conspicuous objects upon the fences and stone walls by the roadside, in the main forks of trees, not unfrequently upon the ground, and sometimes fastened, at a considerable height, to the trunk of the cocoanut.

They are composed of a material resembling papier-mâché, which is probably finely comminuted wood and animal gluten. As they burn readily, but with a smoky flame, the old deserted nests are much used for making smudges in mosquito season. The nest consists of a thin, unbroken, external covering enclosing an irregularly honey-combed mass. The passages and the septæ between them occupy about equal portions of the whole mass; the former might be filled up and the latter dissolved out without greatly altering the character of the structure. The newer outer portions are friable, but towards the centre and bottom the material grows denser, and in some species becomes harder than wood.

At the bottom of the nest is a single entrance from which a covered gallery leads to the earth. These covered ways, of thin papery material, and of about the diameter of a lead pencil, are everywhere met with, even at great distances from any nest, ascending the tallest trees in a straight line, and sending branch galleries along every limb. Almost every cocoanut tree has a termite gallery running up one side of its stem, like a lightning conductor, from its root to its crown. Termites are found streaming up and down them by day as well as by night.

At or near the centre of the nest, in an irregular cavity not much larger than her body, is the solitary queen, distended with eggs, and perfectly helpless. The swollen abdomen in one species is over an inch long and three-tenths of an inch in diameter. In the unimpregnated female the abdomen is about one-tenth as long. The cell in which the queen is imprisoned has very indistinct walls,[1] but the entrances to it are much smaller than the surrounding cavities.

The eggs are removed by the workers, and are usually found at the bottom of the nest. The young are fed upon prepared food which is stored up in the form of very hard and tough rounded masses, evidently composed of comminuted wood. These nodules are disposed without regularity throughout the interior of the nest, and are imbedded in the cellular mass which is cut away to receive them. Some nests contain many pounds weight of them, others of the same species of termite, none at all. Perhaps no nest is at all times supplied. The nodules also vary in size from small grains to lumps larger than a man's head. They are hollowed out by the young termites, which eat into them from the under side.

It may assist the study of the habits and economy of these interesting animals to give, from field notes, the results of an examination

[1] There is no cell, strictly speaking, but a hollow space left among the septæ and the passages. Dr. H.

of several nests made about the middle of February, at which time the winged males and females of several species were beginning to swarm.

No. 1. Nest built upon the ground at the foot of a tree. Contained no winged brood (males and females). They had probably swarmed. Eggs and young were found at the bottom, and nearest the tree. A single queen in her cell at the centre of the nest. Abdomen distended and seven-tenths of an inch long. No eggs near the queen.

No. 2. Quite a large nest; if broken up would fill a a flour-barrel. Placed on the ground near, but not touching, the foot of a palm. Eggs at the bottom. A single queen in the exact centre, and surrounded by termites, who tried to drag her back into the cell out of which she had fallen when the nest was split open. No eggs near the queen, and no winged brood in any stage of growth.

No. 3. A very large nest, size of a hogshead, placed in the crotch of a tree, five feet from the ground. Galleries larger and texture coarser than in the two mentioned above. On cutting into it innumerable winged termites swarmed forth. Some of them made short, weak flights and soon scattered over a wide area, attracting to the spot a great number of birds, lizards, snakes, toads and other animals, which during the two days occupied in the examination of this nest, continued to pursue and prey upon the helpless termites. Winged brood occupied exclusively the external portions of the nest, which to a depth of six or eight inches consisted of thin laminæ, the broad interspaces between them affording greater freedom of movement to their long wings than the intersecting cavities of the interior. These outside layers appear to be a temporary structure built up for the accommodation of the swarming brood, and did not occur in the first two nests. The interior very compact and tough, containing many small nodules scattered through it. A considerable portion of the upper part of the nest presented a more open, reticulated structure, with larger cavities and more rounded partitions of brittle material; this region seemed adapted to the accommodation of the immature termites whose wings were not fully developed, and was chiefly occupied by them.

The bottom of the nest between the forks of the tree was earthy, apparently old and rotten, and contained eggs, or newly hatched termites. A single queen in her cell was found just below the centre. Her abdomen was more than an inch long, but flabby, discolored, and apparently somewhat exhausted by the deposit of eggs. She was surrounded and covered by workers who showed great anxiety when the cell was opened. In the neighborhood of the queen's cell were found five or six sexual individuals with wings wanting. These I suspect had been selected from the swarming brood, and were destined to remain in the nest. Their presence so near the queen may have been accidental, as the loss of their wings would enable them in the disturbance to penetrate the interior. If so, they were the only ones that succeeded out of thousands that became entangled in attempting to leave their proper quarters in the laminated exterior.

Of the asexual workers which swarmed in countless numbers in all parts of the nest, about half were black-headed "nasuti". A very few mandibulate soldiers were seen among the workers.

A large red ant held undisputed possession of a small corner of the nest, from which it appeared to have driven out the termites.

No. 4. Another very large nest built upon a bamboo fence, and enclosing the top rail, which passed through it just below the centre. Queen's cell, with single occupant, rested upon the bamboo rail, as nearly as possible in the centre of the nest. Evidently a younger colony than the last, and the queen whiter, more distended and somewhat smaller. Immense swarming brood filling the laminated exterior. No brittle netted structure in any part of the nest similar to that in No. 3. Nodules very numerous, some of them very large and surrounded by young.

No. 5. Also a very vigorous colony. Nest not so large as the two preceding, placed in the fork of a tree, about six feet above the ground. Exterior layers full of winged brood. Interior very hard and compact, enclosing numerous very large and bright-colored nodules with young. Queen's cell above the centre, most of the nodules below it. A single sexual termite, with wings removed, was found in the cell with the queen. In this case it could hardly have been an accidental wanderer, as a large fragment from the interior, which fortunately proved to contain the queen, was quickly torn out, removed to a distance from the nest and separately examined. A large colony of red ants occupied a corner of this nest, and rendered a careful examination of it impossible.

Several other nests examined with more or less care presented no further peculiarities. A single queen was found in nearly every one. Where no queen was discovered it is probable that she escaped notice from being covered and concealed by the workers which surrounded her, or was chopped up by the cutlass used in breaking up the nests. One small nest placed quite close to a large one, and connected with it by a covered way, certainly contained no queen; she was, however, found in the larger nest in the usual position.

The nests of different species are very much alike in general character and appearance, varying, however, in hardness and in the color of the material from light gray to very dark brown or black. The termites do not all swarm at the same seasons, and some nests are without nodules. Nests deserted by the termites are often found, and they then become hiding places for numerous animals and insects. In such old nests the Yellow-bellied Parroquet (*Conurus flaviventer*) excavates her nest, and several snakes and lizards, particularly a small Gecko (*Sphæriodactylus argus*), select them as places of deposit for their eggs.

Extracts from a Letter by Mr. H. G. Hubbard, relating to the above described Termites.

Insects, including Neuroptera, were so scarce in Jamaica that I gave my attention mainly to other things, and have hardly any biological material, except the termites I send you. I once observed a large swarm of small dragon-flies (about one and one-fourth inches long) acting very much as one sees certain gnats in the autumn here; that is, they kept together in a cloud, and as it was a very windy day they remained for hours in about the same place, under the lee of a large tree, and too high from the ground for me to capture any. I do not remember ever noticing a similar habit in any of our species. I believe Gosse mentions the same thing in his "Naturalist in Jamaica." In both cases they were true *Libellulidæ*, not *Agrions*.

I had less opportunity than I wished to study Termites. I could not do much in travelling about the island by carriage, and it was not until we settled down at a place in the country (Dromilly) that I had a chance to observe their nests attentively. I am inclined to believe that every tree nest, or with few exceptions, contains a single queen. It is very easy to overlook the queen in cutting up a nest, as the royal cell is not very distinct, and the queen is usually surrounded by a dense mass of workers, so that she escapes detection.

Nests Nos. 1 and 2, it seemed to me, were of the same species. I did not find winged, mature or immature Termites in either nest. About a week before I began the examination in detail of these nests, there was a flight of winged termites in their vicinity, but several hundreds of other nests were about, and I could not tell from which they came. These winged ants were, as I recollect, decidedly smaller, but of the same general color with those from nest No. 3. I am afraid I have lost the specimens I collected, at least I have not yet found them. I examined a nest (not mentioned in my notes) which did not differ in any marked way from Nos. 1 and 2, and contained no nodules, but was full of a brood, having dark wings.[1] I cut up the nest but failed to find the queen. I have little doubt she was there, but I was hampered in my examination by the presence of a large red ant which occupied a portion of the nest, and which poured forth in multitudes, covering the ground and the bushes about, so that I worked with a number of the brutes crawling under my clothes and biting me badly.

These red ants I often found even in very new and vigorous Termites nests. They seem to be nocturnal, and always confined themvesels to that portion of a nest which they had first seized upon, and even when disturbed, I never saw one of them enter the galleries of any other part, although I could not discover that any distinct barricade or wall had been made between their corner and the rest of the nest.

One of the small bottles contains a few termites of a small, elongated species, taken out of a gallery running up a palm tree, and among them are mandibulate soldiers. I found no soldiers in the galleries of any other species, and I believe nest No. 3 is the only one[2] in which I found them. Even there they were so few that I am surprised that I detected them at all among the millions of workers. They only occurred, as far as I could see, in one corner of the nest. Of this little species from the palm, I never found the nest. It is possible that the small nests which I sometimes saw in other parts of the island, quite high up and upon the side of the cocoanut trunks, may have belonged to this species, but I never had a chance to examine any of them. I often examined the galleries of Termites remote from any nest, and usually running up living trees. Sometimes they were deserted, but usually a more or less constant stream of workers was going up and down. Once or twice I found in such a gallery nothing but black-headed *nasuti* (long-nosed form), and

[1] *Eutermes morio*. Dr. H.

[2] Belongs to *E. Rippertii*. Dr. H.

once I opened a small nest (two feet in diameter) placed within a foot of the ground, upon the trunk of the coccoloba, or sea-side grape, growing in loose sand and within a few yards of the sea. The whole nest swarmed with black-headed nasuti, and nothing else. I am afraid I have lost these specimens also in part of my baggage which went astray.

At a place twelve hundred feet up in the hills, and consequently in a damp, cool climate, I was searching a small, densely wooded island in the Wagwater River (a considerable mountain stream), when I observed two or three small holes in the end of a small dead branch. Thinking to find Scolytidæ, or ants, I broke off the branch and opened it. To my surprise, I found what appeared to be the commencement of a colony of termites, which had not begun a nest, and had made no external galleries; in fact, they were isolated in a few simple burrows at the end of this short dead branch. The colony consisted of three or four sexual individuals, with wings pulled off, one or two very large mandibulate soldiers, and about a dozen workers, *but no nasuti.* As there was not a trace of the material of which nests and galleries are composed, the absence of *nasuti* is possibly significant. On the other hand, this may be a species which does not build nests or galleries. The branch in which they were did not weigh more than two or three ounces, and was the broken butt of a branch on a living tree, and about four feet from the ground. Certainly it seems probable that a nest in time would have been constructed with a gallery leading to the ground, for I do not suppose these, or any termites, would burrow into living wood. They were collected at Stony Hill, near Kingston, on March 10, 1877.[1]

From the nests mentioned in my notes, I send you a full series of everything I collected. Nests of the species to which Nos. 3 and 5 [*E. Rippertii*] belong, were usually very large. I cut them with a long-bladed cutlass. The outside (of which I send a specimen) cut easily, like pie-crust, but the interior was harder, and especially in the neighborhood of the queen's cell was very tough indeed. When one considers the immense mass of the nest, as big as a hogshead, every part of which swarms with termites in countless thousands, one will understand the difficulty of hunting up the queen. In my examination of nest No. 3, I did not expose the queen's cell until after two days' work. When I first cut into the nest, order reigned

[1] *Calotermes castaneus* sp. Dr. H.

inside. The adult winged termites were all in the exterior layers, built, I think, for their accommodation, and the immature males and females were probably also in their proper place. But of course soon everything became confused. The long winged adults tried to hide in the interior, and crowded into the narrow galleries, while the undeveloped ones scattered through every part of the nest. I could not be sure that in the disturbance, some adult termites which had been relieved of their wings, had not also penetrated into the neighborhood of the queen's cell. As, however, I only found four such, I am inclined to think their presence there was not accidental. You can probably determine whether they are males or not.[1] In the case of nest No. 5, where a single sexual form, with wings removed, was found in the cell with the queen, I do not think there is much room for doubt. It could hardly have been an accidental wanderer, as I luckily struck the queen cell in a few minutes after cutting into the nest, and the greater part of the nest was left undisturbed in the crotch of the tree. Indeed, I could not approach it at all from one side, which was partly occupied by red ants, so I tore out a large fragment from the interior containing many large nodules, and carried it away from the vicinity of the flying winged termites. In this, fortunately, I found the queen.

No. 5 was quite a large nest, very bright colored, and apparently younger than the others. The nodules, a number of which I send you, also looked bright and new, and even very large. You will notice the eroded appearance where the young termites have gnawed them away. I noticed several of the queens from the older nests (especially the one from nest No. 3) looked more or less exhausted and partially discolored, so that I thought they were dead and decaying at first, but in every case they proved to be alive. When I lifted them up with my forceps by the middle, the two portions of the abdomen hung down, so as to bring the head and anal extremity together. They were soft and flabby, but after they had been a week or two in alcohol they became plump and rigid again. Queen No. 3, which was quite discolored, seems to me to have brightened considerably. Some of the queens were, however, very plump and white when taken from the cell.

Besides termites I send you a few larvæ, etc., of Neuroptera, collected in the Wagwater River, at Stony Hill, near Kingston. Among them are the cases and larvæ of *Helicopsyche*, but I had no chance to raise the imagos, and some larvæ of Isephenus.

[1] All are males. Dr. H.

Notes on Eutermes Rippertii. By S. H. Scudder.

The nests of the white-ants found at the Isle of Pines in 1864, as I recollect them, were about the size of a man's head, and dome-shaped. According to notes taken at the time, the first of them was found resting on the ground around the base of a small tree; and I believe that all the others were similarly situated, and that the trees were not more than an inch in diameter. The outside crust of the nest was made of a loosely compacted earth, while within it, at the depth of about an inch or two, was a much firmer material, a closely cemented hardened earth, two or three inches thick, which required a hatchet to break; within, it was softer again. The nest extended an inch or two below the level of the gravelly soil, and most of the milk-white larvæ were found in this part of the nest. The queen was found near the middle of the nest, beneath its very hardest part, upon the easterly side; and on the same side the black workers were much more abundant than elsewhere. Several nests were opened and a single queen taken from each (at least I find no notice of a second queen); the first nest that was despoiled was visited the next day (about eighteen hours after destruction), and the open parts were found entirely covered with fresh earth, and crowds of workers were running about with larvæ in their mouths. Several day's search failed to discover a deserted nest.

General Meeting. January 2, 1878.

The President, Mr. T. T. Bouvé, in the chair. Forty-six persons present.

The following gentlemen were elected Associate Members: — Messrs. Frank T. Stanley, W. L. Whittemore, Edw. W. Ropes, Edw. L. Mark, Arthur C. Gould.

The following paper was read: —

On the Geology of the Eozoic Rocks of North America. Abstract. By T. Sterry Hunt.

The speaker proceeded to discuss the geology and geography of the Atlantic belt, and insisted upon the great groups of crystalline Eozoic rocks which he therein recognized and described under the names of Laurentian, Norian, (Upper Laurentian of Logan) Huronian, and Montalban. Under these four heads we may conveniently include all the crystalline rocks of that belt, with the exception of the Taconian, to be mentioned farther on, although it is probable that farther researches will enable us to establish other subdivisions.

During a late journey across the continent he had been able to make some observations on the crystalline rocks west of the Mississippi, and to compare them with those of the Atlantic belt. His examinations among the Rocky Mountains were made in the Sangre de Cristo range near Garland; and in the Front or Colorado range at Glen Eyrie, in the Ute Pass, in Clear Creek Cañon, and about Georgetown. In all of these localities he found gneisses, often hornblendic, but scarcely micaceous, and in many cases in large masses, often granitic in aspect, with rarely interbedded gneissic layers. These strata are penetrated in the vicinity of Georgetown by well-marked granitic masses, probably exotic. The red granitoid rocks at and near Sherman on the Union Pacific R. R. are probably gneissic. These various rocks have all the lithological characters of the Laurentian as displayed in the Laurentides, the Adirondacks, and the South Mountain between the Hudson and Schuylkill Rivers. Dr. Hunt here referred to the published observations in Hayden's Report for 1873, of the late Mr. Marvine, who had studied these rocks in the Colorado range and had then compared them with the Laurentian. The speaker here mentioned the labradorite rocks having the characters of the Norian, and associated, like that series in the east, with large masses of titanoferite. These rocks, found in Wyoming territory, were however, known to him only through specimens.

The gneissic rocks of the Wahsatch range, as seen in the Devil's Gate on the Weber River, are also Laurentian, to which are to be referred the similar stratified rocks found in the same range farther south, in the upper part of the Little Cottonwood Cañon. Here, among loose blocks of the gneiss, the speaker found occasional masses of coarsely crystalline limestone with mica, and also varieties of pyroxenic rocks characteristic of Laurentian; at the lower part of this same cañon there are, however, well-marked eruptive granites.

The crystalline schists examined by the speaker in the foot-hills at the western base of the Sierras in Amador, Placer, and Nevada counties in California, have, according to him, all the characters of the Huronian series as seen on the great lakes, in Eastern North America, and in the Alps. The auriferous quartz veins in the counties above named, are found traversing alike the crystalline schists and the granites of the region, which are probably eruptive masses newer than the schists. To the Huronian he also refers the similar crystalline rocks of the Coast range of California, as seen near San Francisco and in the vicinity of San Jose.

Referring then to the Atlantic belt, and to the South Mountain in Pennsylvania, the speaker mentioned that in the continuation of this range between the Susquehanna and the Potomac, the Laurentian gneisses are concealed beneath strata referred to the Huronian, including a great development of petrosilex rocks, often porphyritic.[1] Rocks of Montalban and Huronian age are met with along the line of the Baltimore and Ohio R. R.; but at Bellisle near Richmond, Virginia, he had recognized the characteristic gneisses of the Laurentian.

He then gave a preliminary account of some late observations made in a journey across the Blue Ridge in Mitchell county, North Carolina. The gneisses of Roan Mountain, and the similar rocks at its western base, which include large masses of very pure magnetic iron ores, are Laurentian, but indications of a belt of Huronian schists, with steatite, unctuous mica-schists, and specular iron ore, were met with along the western flank of the mountain. To the eastward, the Laurentian gneisses are succeeded by a great breadth of thin-bedded gneisses, with highly micaceous and hornblendic schists, referred by the speaker to the Montalban series, in which is included the narrow belt of dunite or olivine rock found on the line of section near Bakersville. These Montalban strata are intersected by numerous endogenous granitic veins, which are extensively worked for mica, and yield, moreover, fine cleavable masses of orthoclase and of albite, together with beryl, apatite, and the rarer minerals, autunite and samarskite. The rocks of this series, often decomposed to considerable depths, were found to occupy the greater part of the country as far east as Salisbury, interrupted however, near Statesville, on the Western North Carolina R. R., by granitoid gneisses which have the characters of the Laurentian.

The belt consisting of granular quartz rock, with limestone and hydrous mica-slates which was seen by the speaker at the eastern base of the Blue Ridge on the Catawba river, near Marion, has all the characters of the Lower Taconic, to which it was long since re-

[1] Proc. Bost. Soc. Nat. Hist., Vol. XVII, page 509.

ferred by Emmons. Portions of this quartzite are thinly bedded and flexible, constituting what is known as itacolumite. It is regarded by the speaker as identical with the Primal white sandstone of Pennsylvania, which with the Auroral limestone and its interstratified and overlying unctuous schists, and the succeeding roofing slates, constitute a distinct geological horizon. This series, having an estimated thickness of about 5,000 feet, is found resting alike on Laurentian, Huronian and Montalban, and is overlaid, probably unconformably, by the Upper Taconic, which is the Quebec group of Logan. The Lower Taconic is apparently identical with the limestone series of St. John, New Brunswick, which is succeeded by the Menevian slates, and to the Hastings limestones of Ontario, there unconformably overlaid by the Trenton limestones.[1]

This Lower Taconic series, which is very distinct from the wholly uncrystalline Upper Taconic, the speaker distinguishes by the name of Taconian. It is, although in part detrital, essentially crystalline, and its rocks, while distinct from all those of the previously named crystalline groups, have certain lithological resemblances with each of them. The magnesian limestones of the series sometimes contain serpentine, and more often mica, which is frequently finely disseminated, while the associated schists are sometimes in large part made up of a hydrous mica. Crystalline specular and magnetic iron ores are found abundantly in this series, as well as large beds both of carbonate of iron and of pyrites, from the oxydation of the one to the other of which, in place, as has been shown by the speaker, there have been derived the great masses of brown hematite ore, found so abundantly along the outcrop of the Taconian series, from Vermont to Alabama. The stratified clays often enclosing these ores, are the results of the decay of the enclosing crystalline schists, which like still older crystalline strata along the eastern border of the Appalachian valley, are in many cases decomposed to considerable depths.

The direct evidences of organic life in the Taconian rocks are certain markings named *Scolithus*, which are, however, distinct from what has been called by the same name in the Potsdam sandstone of New York and Wisconsin. These, apparently, are found both in the quartzites and the limestones of the series, and the latter moreover contain an obscure and undescribed linguloid shell, and possibly some other organic forms. The question as to whether these rocks are to

[1] Proc. Bost. Soc. Nat. Hist., Vol. XVII, page 509.

be regarded as the equivalents of the ancient strata found in Norway, to which Kjenelf has given the name of Taconic, or of the oldest Cambrian beds of Sweden and of Wales, was discussed, and the evidence declared insufficient for a solution of the problem. In the limestones and slates of Hastings County, Ontario, which have been already referred to the Taconian, Scolithus has been found by Dr. Dawson, together with a form of Eozoon closely resembling that of the Laurentian.

Mr. J. A. Allen read a paper on an inadequate "Theory of Birds' Nests," criticizing Mr. A. R. Wallace's views on the relation between the colors of a bird and the character of its nest.

Mr. F. W. Putnam exhibited a specimen of the common eel (*Ang. bostoniensis.*)

This was one of eight eels received at the Museum of Comparative Zoology on the 31st of Dec. from Mr. Vinal N. Edwards of Woods Holl. A few weeks since Prof. Baird informed Mr. Agassiz that Mr. Edwards had discovered eels with eggs, and, at Mr. Agassiz's request Mr. Putnam at once wrote to Mr. Edwards asking him to send specimens to the Museum. The reply was the reception of the eight specimens mentioned, which were obtained by Mr. Edwards in the market at New Bedford. Thus to Mr. Edwards belongs the credit of bringing to notice in this country eels with eggs. As is pretty generally known, it has been somewhat of a mystery how, when and where eels were developed, and many singular and fanciful statements have been made regarding the method of reproduction of this very common fish. At present all that is known, is that this year, for a month past, the eels brought into New Bedford are with eggs in various stages of development. Where they spawn is not yet known, so far as Mr. Putnam was aware, but Prof. Baird, the U. S. Commissioner of Fisheries is now undoubtedly investigating this important and interesting subject. Attention was here called by Mr. Putnam to the translation of the paper by Dr. Syrski contained in Prof. Baird's last report, p. 719. The eight specimens received, and examined by Mr. Putnam, had the ovaries in various stages of development. In two the ovaries were very small and the eggs in them exceedingly minute. From these the series showed a gradual increase in the size of the ovaries and the contained eggs, to the specimen exhibited, in which the eggs were still so small as only to be seen by a lens of considerable magnifying power, and not yet ready to be excluded, though the ovaries themselves were large and full. The fact of the great rarity of eels with eggs, and the occurrence in these specimens of ovaries in various stages of development, seem to show that, in contrast with the more usual slow development of the eggs in fishes generally, the eels rapidly attain their seasonal development, the ovaries immediately after the eggs are laid being reduced to a minute size.

As seen in the specimen exhibited, the ovaries are white, or colorless, slightly plicated, and of great length, extending from the base of the liver along each side of the intestines to and beyond the anal opening, the left ovary passing for some distance into a cavity of the muscles on the side of the anal fin, while the right ovary does not extend quite so far.

The eggs, when mature, are dropped into the abdominal cavity, from which they must pass by two very small peritoneal outlets, situated on each side of, and just posterior to, the anal opening. There is a very vascular, and apparently sensitive, region on the inner side of these peritoneal outlets, with a free communication from side to side.

It may prove of importance to note that these eight female eels are all silvery on the under side and are the form known as "silver bellies." Will the "golden bellies" prove to be the males?

The thanks of the Society were voted to Mr. A. J. Lewis for specimens of birds presented to the New England collection.

General Meeting. January 16, 1878.

The President, Mr. T. T. Bouvé, in the chair. Thirty-five persons present.

The President showed a curious mass of silver ore from Norway, having some fine crystals and a nodule amazingly resembling a tiny bird.

Mr. George W. Bond read a paper on the Origin of the Merino Sheep, in which he claimed the Arabian as the ancestral stock of that race.[1]

Section of Entomology. January 23, 1878.

Mr. J. H. Emerton in the chair. Six persons present.

The following papers were presented: —

REMARKS ON CALLIPTENUS AND MELANOPLUS, WITH A NOTICE OF THE SPECIES FOUND IN NEW ENGLAND. BY SAMUEL H. SCUDDER.

The genus Calliptenus was founded by Serville in 1831 in his *Revue Méthodique* under the name Calliptenus,[2] with three species, *Acrydium sanguinipes*, *A. italicum* and *A. morio*, each being placed as a representative of a distinct subdivision. In 1838 Burmeister, and in 1839 Serville himself, retained *C. italicus* alone in the genus, and it therefore became its type.

Until within a few years, all authors who have treated of the American species placed by Burmeister in this genus, or of their congeners since described, have referred them to Calliptenus, if they have separated them at all from Acridium. In 1873 Dr. Stål in his admirable *Recensio Orthopterorum* first pointed the differences which exist between the European *Cal. italicus* and the North American species which had been referred to that genus, and the closer connection of the latter with Pezotettix. Our common *C. femur-rubrum* was placed by him in a subgenus of Pezotettix which he termed Melanoplus. Without considering the intimate relationship which undoubtedly exists between Melanoplus and the true Pezotettix, it will be enough at the moment to assume that the great variety of forms in this country in either group, will necessitate our separating them under distinct names even should they prove as closely allied as Stål's arrangement would indicate. For the assistance of American students the characteristic differences of structure between

[1] This paper will be found in full in Bull. National Assoc. of Wool Manufacturers, Vol. VIII.

[2] On orthographic grounds, Burmeister afterwards changed the name to Caloptenus; but Erichson more properly wrote it Calliptenus, in which he is followed by Stal.

Calliptenus and Melanoplus are pointed out, that the change of names which it will necessitate may not appear to those unacquainted with the scholarly work of Stål to be capricious. For better comparison the differences are presented in a tabular form.

Calliptenus.	*Melanoplus.*
Eyes proportionately larger in ♂ than in ♀; in the former broader than the length of the genæ.	subequal in ♂ and ♀; in both generally narrower, never broader, than the length of genæ.
Upper base of antennæ opposite the middle of the eye.	slightly below the middle of the eye.
Deflected lobes of pronotum abruptly separated from the dorsal area by a distinctly elevated carina.	passing almost insensibly into the dorsal area, there being no distinct lateral carinæ.
Meso- and matasternum together equally long and broad.	together longer than broad.
Metasternal lobes almost transverse, more widely separated than in Melanoplus, the posterior edge convex throughout.	oblique, directed backward as much as inward, the posterior edge more or less excavated next the hind coxæ.
Mediastinal vein of tegmina striking the costa at the middle of the outer two-thirds of the wing.	striking the costa beyond the middle of the outer half of the wing.
Discoidal cell of same terminating in the middle of the wing.	terminating beyond the middle of the wing.
Vena intercalata of same wanting.	distinctly present.
Branches of the principal veins much less numerous than in Melanoplus at the tip of the tegmina; they are also more oblique, and have a normal distribution.	running parallel with the principal veins, and remaining in close proximity to them throughout the tegmina, making the framework of the wing appear as if formed of an excessive number of principal veins, and adding greatly to its power in flight; they are but little oblique even at the tip of the wing.
Hind femora broad and stout, the upper margin serrate.	slenderer than in Calliptenus, the upper margin smooth.
First joint of hind tarsi longer and very much stouter than the last joint; arolium small.	only a little stouter than, and of equal length with, the last joint; arolium large.
Penultimate segment of ♂ abdomen not noticeably larger than the preceding, leaving the abdomen horizontal.	much swollen and expanded on the ventral surface, noticeably larger than the preceding segments, throwing the tip of the abdomen upward.

Anal cerci of male of excessive length, very conspicuous, more than one-third the length of the hind tibiæ.	moderately large but not excessive, seldom one-fifth the length of the hind tibiæ.
Segment preceding supra-anal plate of male entire, without margin apophyses.	furnished with more or less conspicuous, paired, marginal apophyses, arising from the middle of the hinder edge, generally taking the form of pointed, more or less depressed, divergent lobes, lying in the lateral sulci of the supra-anal plate.

It has been generally supposed that we had only two species of Melanoplus in New England, the common species mentioned by Dr. Harris in his Report on Injurious Insects, under the names *Acridium flavovittatum* and *A. femur-rubrum.* Mr. Uhler indeed had given a MS. name to a single specimen of a distinct species from Maine, and I had described the same in 1862 under his name *Caloptenus punctulatus;* but as no other specimens were discovered, doubt was thrown upon its proper habitat; others, however, have now been found, and the species appears to be peculiar to the Northern States. More recently, Mr. Riley has described a fourth species (which has been separated from *M. femur-rubrum* in my cabinet for ten years) under the name of *Cal. atlantis*;[1] and in the present paper two additional species are made known which will be more fully described in a memoir now in preparation.

These six species may be separated by the following table.

1. Tegmina scarcely exceeding, often much shorter than, the abdomen. *Male* with the median marginal apophyses of the last dorsal segment no longer than the segment itself. *Female* with the basal tooth of the lower valves of the ovipositor small, obscure, blunt, much broader than long. Two callosities on the under surface of the first hind tarsal joint. . . . . **2.**

Tegmina much exceeding the abdomen. *Male* with the median marginal apophyses of the last dorsal segment more than twice as long as the segment itself, extending conspicuously along the lateral sulci of the basal half of the supra-anal plate. *Female* with the basal tooth of the lower valves of the ovipositor prominent, sharp, nearly or quite as long as broad. Three callosities on the under surface of the first hind tarsal joint. . . . . **5.**

[1] This was first called atlanis by Riley; but in his later writings he has used the corrected form, atlantis.

2. Moderately large species. Fastigium with parallel walls directly continuous with those of the frontal carina. Median carina of pronotum more or less distinct on foremost division of anterior lobe. *Male* with the apex of the last abdominal segment sharply conical; anal cerci expanding apically to a broad plate. . . . **3.**

Small species. Tip of fastigium expanding laterally next the upper ocelli. Median carina of pronotum very obscure or wanting on the foremost division of the anterior lobe. *Male* with the apex of last abdominal segment obscurely conical and docked; anal cerci equal or apically forked. . . . . **4.**

3. Antennæ brightly colored; eyes not prominent; upper limit of deflected lobes marked by a yellow stripe which extends on to the head; median and anal fields of the tegmina, otherwise immaculate, separated by a similar stripe; posterior lobe of pronotum nearly smooth; hind tibiæ red. *Male* with the anal cerci expanded at the base. *Female* with the upper valves of the ovipositor tapering, finely pointed. . . . . *M. femoratus* (Burm.)

Antennæ dark colored; eyes prominent; no lateral stripe on the pronotum or tegmina, the latter of which are spotted irregularly with dusky blotches; posterior lobe of pronotum rather coarsely punctate; hind tibiæ particolored. *Male* with the basal half of anal cerci equal. *Female* with the upper valves of the ovipositor scarcely tapering, bluntly pointed. . . . *M. punctulatus* (Uhl.) Scudd.

4. Transverse sulci of anterior lobe of pronotum distinct; upper half of divergent lobes but little darker than the lower half; tegmina as long as the abdomen. *Male* with the anal cerci forked at the tip. *Female* stout. . . . . *M. collinus* n. sp.

Transverse sulci of anterior lobe of pronotum indistinct; upper half of divergent lobes strikingly darker than the pale lower half; tegmina much shorter than the abdomen. *Male* with the anal cerci equal or nearly equal throughout, long, slender, and nearly straight. *Female* rather slender. . . . . . *M. rectus* n. sp.

5. *Male* with the marginal apophyses of the last dorsal segment stout, parallel, reaching half way over the supra-anal plate; anal cerci tapering, pointed at tip, not more than half so broad on apical as on basal half; apex of last abdominal segment entire. *Female* with the median carina of the pronotum generally distinct on the anterior lobe; prosternal spine nearly cylindrical, scarcely tapering excepting at the extreme tip, which is generally bluntly rounded. . . . . *M. femur-rubrum* (De Geer) Stål.

Male with the marginal apophyses of the last dorsal segment slender, divergent, reaching scarcely one-third way over the supra-anal plate; anal cerci broad, equal, broadly rounded at tip, scarcely twice as long as broad; apex of last abdominal segment notched. *Female* with the median carina of the pronotum generally indistinct or wholly wanting on the anterior lobe; prosternal spine tapering, generally bluntly pointed at tip. . . *M. atlantis* (Ril.)

M. femoratus is the species generally called *Cal. bivittatus*. The latter, however, is an interior species, while this, as will be seen in the succeeding paper, extends across the continent. It is common everywhere in New England, and the female lays from seventy to ninety eggs. From the abdomen of one I once extracted a species of Mermis (?) at least six decimetres long. These insects are very fond of a species of Inula (*I. Helenium*) growing by road-sides, and sun themselves on its broad leaves.

M. punctulatus is a rarity, and most of the specimens I have seen have been without definite locality. I have taken it in Andover, Mass., in November. Mr. Uhler gave me a specimen from near Boston, Mr. Henshaw has taken it in Massachusetts, Dr. Packard in (Brunswick?) Maine, Baron Osten Sacken sent me a specimen from the Middle States, and the late Mr. Walsh another from Illinois. I formerly noted that I had taken it in Vermont, but I think this must be an error. The species is allied to *M. Helluo* (*Cal. Helluo* Scudd.) from the South.

M. collinus is not a rare species. It is allied to *M. luridus* (*Cal. luridus* Dodge). It occurs in abundance at Sudbury, Vt., where eleven years ago I first recognized it as distinct from other species, and occurs in the vicinity of groves in dry hilly pastures; comparatively few *M. femur-rubrum* are found with it, the latter affecting open sunny spots in hollows and the lowlands. The young of the two species may readily be separated. I found this species devouring perfectly dead and dry hickory leaves. I have also taken it in Andover, about Boston and on the island of Nantucket in this State, and Mr. Henshaw has sent it to me from Jamaica Plain.

M. rectus is again a rarer species. I have seen few specimens. Mr. Henshaw captured it at Jamaica Plain, Prof. S. I. Smith formerly took it in Norway, Maine, and I have a single specimen taken in the White Mt. valleys of New Hampshire. The species is nearly allied to *Mel. devastator* Scudd. from the western part of the country.

M. femur-rubrum is the commonest species of all. On account of its abundance and its extensive range (see the succeeding paper) I have long considered this form of Melanoplus as in all probability the true *A. femur-rubrum* of De Geer; but Dr. Stål has fortunately for us described the anal cerci of the male from De Geer's type, leaving us quite certain of his species. Abbé Provancher has recently redescribed it under the name of *Cal. sanguinolentus.* Collecting this species in large numbers in different stations at Sudbury, Vt., I noticed that specimens found in moist low ground were darker and had more vividly contrasted colors than those found in the hollows of dry upland pastures. I also thought the former to be longer winged but took no measurements to verify this point.

M. atlantis is everywhere common, being apparently about half as numerous as *M. femur-rubrum* in every locality I have collected, excepting at the highest elevations, as among the White Mts., where it appears to be about equally abundant. Both occur on the alpine summits. Taking New England as a whole *M. atlantis* is more abundant than *M. femoratus*, and is particularly so in the South where the latter begins to decrease in numbers. In Nantucket the species takes on a peculiar coloring and nearly all the specimens have pale glaucous hind tibiæ. Fuller details of these differences will be published hereafter.

Mel. junius (*Pez. junius* Dodge) has been taken about Quebec by Abbé Provancher, but has not been detected in New England. Abbé Provancher described it (only a few months later than Mr. Dodge) under the name *Cal. minor.*

Brief Notice of the American Species of Melanoplus found West of the One Hundred and Seventeenth Meridian. By Samuel H. Scudder.

The collections of Orthoptera made during the last summer by Dr. A. S. Packard, together with a series sent me by Mr. Henry Edwards of San Francisco, and others collected by the late Mr. Crotch, or previously in my collection, enable me to give some idea of the distribution of Melanopli on the Pacific coast. In this enumeration I do not count some species from the extreme southern portion of California, west of the 117th meridian, obtained by Dr. Edward Palmer, but leave them for another occasion. In the district as I have limited it in the title of this paper, nine species of Melanoplus are found, only one of which appears to be confined to it. This is the one I have called *M. collaris*; it comes from the extreme south, on the borders of Lake Tulare at the upper waters of the San Joachin, and is remarkable for its resemblance to *Pezotettix enigma* Scudd., a peculiar species also found in southern California, but only known west of the Coast Range. We cannot yet speak definitely of *M. spretus* (Uhl.), for although it has certainly been taken in this region, it may not be native to it. Perhaps the researches of Dr. Packard will establish this point. Probably all the others are found upon both sides of the Sierras and their northern extension, although one, a very small species, *M. Kennicottii* (which I once[1] wrongly referred to *Cal. bilituratus* Walk., from specimens taken by Mr. Dawson on the Souris River, a tributary of the Assiniboine) is probably confined to the eastern side, as the only other specimens I have (males) were taken by Mr. Kennicott on the Yukon River, south of which the mountains trend westward. Still another, *M. Packardii*, may also belong only to the east, for it is an abundant species as far eastward as Great Salt Lake, the South Park and southern Colorado, Nebraska and Texas, and was taken by Dr. Packard at Wallula on the Columbia, and by Mr. Crotch in British Columbia — at what point is unknown. The other species certainly occur on both sides, and most of them have a wide range. *M. femur-rubrum* (DeGeer), for example, which is abundant over its whole area of distribution, has been taken at Sissons, Cal. (Packard), Ft. Redding (Pac. R. R. Surv.), the same and other points in California (Edwards), Portland, Or. (Packard, Edwards), Great Bear Lake (Kennicott), and also occurs at Great Salt Lake, Pueblo, Col., central Texas (Belfrage), and even central Mexico (Sumichrast); from these points it extends eastward to the Atlantic, where it ranges from Canada to central Florida; — having, probably, as wide a range as any Acridian on the continent. *M. atlantis* (Ril.) proves by its scarcely less extended distribution, the impropriety of its name; it is a more northern species, extending, on the Atlantic coast from Canada to North Carolina, and westward through the northern United States, and all parts of Colorado to Salt Lake, where it is extremely abundant, to California, Wallula, Portland, Or., British Columbia, Victoria, Vancouver's Island, and the Yukon River, Alaska. *M. devastator*, a species which, probably, rather than *M. atlantis*, is the source of most of the damage to crops in California, besides being especially abundant in the Shasta Valley, and found also at Sissons (Packard) and Sauzalito, Cal. (Behrens),

[1] G. M. Dawson, Rep. Geol. and Resources Forty-ninth Parallel, p. 343.

occurs about Lake Tahoe, Reno and Glen Brook, Nev. (Packard); and was taken by myself sparingly at Beaver Brook and Morrison, Col. Another species, which in allusion to its ashen tints is here called *M. cinereus*, has been sent me from California and Nevada by Mr. Edwards, and was taken by Dr. Packard at Wallula, W. T., and at Reno, Nev., and by myself in great numbers at Great Salt Lake and in the American Fork Cañon, Utah. Possibly it is this species (I have only poor specimens to judge from), which Capt. Pope took in Texas, on the upper Pecos River. Finally the common *M. femoratus* (Burm.) of the east, where it ranges from Maine to N. Carolina, has been found at Wallula (Packard), British Columbia (Crotch), and the Shasta Valley (Edwards).

The following table, based on the structure of the abdomen, may serve to separate the males of these species.

1. Penultimate segment of abdomen conspicuously inflated beneath . . . . **2.**
Penultimate segment of abdomen not conspicuously inflated beneath . . . . *M. collaris.*

2. Apex of last abdominal segment distinctly notched . . . **3.**
" " " " entire or most obscurely notched . . . . **5.**

3. Anal cerci broad, rarely more than three times as long as broad, the apical half bent on the basal . . . . **4.**
Anal cerci slender, equal, straight, nearly four times as long as broad . . . . *M. devastator.*

4. Anal cerci more than twice as long as broad . . . *M. atlantis.*
" " less " " " " . . . *M. spretus.*

5. Anal cerci enlarged at the apex, the last segment of abdomen produced . . . . **6.**
Anal cerci tapering, or equal at the apex . . . . **8.**

6. Anal cerci strongly depressed, and a little twisted on apical half . . . . *M. cinereus.*
Anal cerci with apical half slightly bent, or in the same plane with the base . . . . **7.**

7. Lower edge of anal cerci toothed . . . . . *M. femoratus.*
" " " " not toothed . . . . *M. Packardi.*

8. Species of medium size; last segment short; anal cerci much narrower in distal than in basal half, several times longer than the mean width . . . . *M. femur-rubrum.*

Species minute; last segment of abdomen produced at the tip; anal cerci subequal, rounded at the tip, scarcely twice as long as the mean width . . . . *M. Kennicottii.*

Concerning the synonymy of these species, it may be remarked that the name under which I described *Cal. fasciatus*[1] being preoccupied, I have thought it most appropriate to apply to the species the name of one of the members of the national Entomological Commission, who has done the most to extend our knowledge of the Melanopli of the extreme west. Walker's species are, in nearly every instance, described from females only, and characters used which apply equally well to nearly every species, so that it will be long before we know what they are; it would appear probable, however, that his *Cal. bilituratus* is Riley's *Cal. atlantis*, and his *Cal. scriptus* DeGeer's *Acrid. femur-rubrum.* As to the former, the discovery of the wide extent of its range, combined with its other features, satisfy me that it must be separated from *M. spretus* (Uhl.) as Riley claims, although there are few differences between the two besides length of wing and of anal cerci; while both differ to so much greater a degree from *M. femur-rubrum* that it is not a little strange that Mr. Riley should have so persistently endeavored to show how *M. atlantis* should be distinguished from *M. femur-rubrum*, rather than from *M. spretus.*

Of the species here named for the first time, and of which we shall give full descriptions in a future paper, *M. collaris* is a species which cannot possibly be confounded with any other. It is brightly colored, with blue hind tibiæ, a body much brighter yellow than usual, the antennæ very light yellow, and the front edge of the pronotum with a narrow yellow rim. The sternal spine is pointed, and the front division of the pronotum slightly swollen. *M. devastator*, but for its anal cerci, would appear to be more closely allied to *M. spretus* than *M. atlantis* is. The wings vary greatly in length, sometimes nearly equalling those of *M. spretus*, at other times but slightly surpassing the abdomen. The hind tibiæ are usually red, although of not so deep a color as in *M. atlantis*; but Dr. Packard brought specimens from Shasta Valley and Sissons, Cal., in which they are

[1] Proc. Bost. Soc. Nat. Hist., XVII, 477.

deep blue, and one from Lake Tahoe in which they are very pale green; the markings also vary greatly, but the pronotum seldom appears to possess a very distinct black band on the upper portion of the deflected lobes; the tegmina may be almost devoid of spots, but generally possess a distinct discal series of quadrate spots. This species has been distributed by Mr. Edwards with the number 94 attached. *M. cinereus* is a peculiar species, very distinct from any yet described. The female wholly resembles the male, and the hind tibiæ are always blue; the black stripe of the deflected lobes of the pronotum is followed beneath by livid tints in broken patches. It is a slender species, with wings longer than the body, the tegmina with a discal series of slender, alternating pale and dark lines and dots; the posterior lobe of the pronotum, and that only, has rather a prominent median carina. *M. Kennicottii* is a minute species, only fifteen millimetres long, of a dark brown color, with hind tibiæ apparently of a reddish yellow color, hind femora barred above with black, and a lateral black stripe on the front half of the deflected lobes of the pronotum. The prosternal spine is very blunt, the median carina of the pronotum is distinct, and nearly equally so throughout; the tegmina are blotched along the middle line; the anal cerci are thick, less than twice as long as broad, nearly equal and rounded, resembling most those of *M. spretus*.

An examination of the species previously known brings to light one or two points which may be added. Specimens of *M. atlantis* from the vicinity of Puget Sound are darker, and the tegmina more heavily marked than elsewhere, especially in the female. No blue tibiæ have occurred among them. This species was numbered 90 and 157 by Mr. Edwards. *M. femur-rubrum*, on the other hand, does not appear to differ in the least from average specimens on the Atlantic coast; but Dr. Packard brought home a very curious male from Portland, Or., in which the terminal segment of the abdomen is deeply cleft in the middle by an incision which extends nearly across the entire segment. This seems to be due simply to some accident, perhaps in moulting, but it bears an entirely normal appearance, and, occurring just where the segment is notched in *C. spretus* and its nearest allies, led me at first to place it aside as a distinct species; in every other part of its structure, however, it agrees with ordinary specimens of *M. femur-rubrum*. Mr. Edwards has distributed the Californian *M. femur-rubrum* under the numbers 95 and 156.

M. femoratus (Burm.) has been distributed by Mr. Edwards under the number 161.

The Anatomy of the Head, and the Structure of the Maxilla in the Psocidæ. By Edward Burgess.

Westwood, in his "Classification,"[1] describes the maxilla of the Psocidæ — the family of minute insects which includes the well-known "book-louse" — as "elongated, fleshy at the tip, armed with a long, slender, curved, horny process, arising from the base, and longer than the maxillæ." This description, although correct, like most of its author's, as far as it goes, fails to call attention to the really unique structure of the maxilla in this group of insects. Other writers[2] have given us no fuller or more satisfactory description, a fact for which the minute size of the Psocidæ and the consequent difficulty of examination perhaps accounts. I have recently carefully studied the general anatomy of the head in Psocus and Atropos,[3] of which I offer the following description.

The maxilla in Psocus is hinged to the head by a small obscure piece, which is immovably soldered to a larger joint. The first piece represents, probably, the cardo of a typical maxilla (Plate 8, figs. 1, 3, 4 and 6, *c.*), and the second, the stipes (*p.*). The stipes bears outwardly the four-jointed maxillary palpus, while inwardly is hinged a thick, fleshy lobe, broad at the base, but soon contracting and curving inwards (figs. 4 and 7). The tip is flat and has a broad, oval outline on the inside, and is strengthened by several imbedded chitinous rods and other pieces (fig. 7). This lobe, by its position and shape, is doubtless homologous with the ordinary outer maxillary lobe, or galea, of the other Orthoptera. Behind the lobe, that is, between it and the tongue, lies the "horny process" of Westwood's description, or "fork," as I shall call it. This is a slender, more or less curved, chitinous rod, with a forked, bifid tip, and two or three times as long as the outer lobe (fig. 7, etc., *f.*) The distal portion of the fork, about one-third or less of its length, projects through the lining membrane of the mouth. At this point the fork is stoutest, and from it it tapers to either end, the outer portion being stouter than the in-

[1] Vol. II, p. 17, fig. 59,4.

[2] It will not be out of place to refer to the only paper we have on the anatomy of any species belonging to the Psocidæ, viz.: "Ueber die Eingeweide der Bücherlaus (*Psocus pulsatorius*)" von C. L. Nitzsch, Germar's Mag. d. Entomologie, IV, 276. Tab. II. The author excellently describes and figures the reproductive and digestive systems of the Book-louse, but does not refer to the mouth organs or salivary glands. Mr. Scudder, Psyche, II, 49, has erroneously described the maxilla of Atropos as two-jointed.

[3] See Psyche, Vol. II, No. 43.

ner. The membrane, where it is united with the fork, is delicate and elastic, thus permitting the fork to be projected forwards or drawn back at will. Within the head the fork is held in position by muscles inserted on its base (fig. 7, *m.*, *m.*^{1} and *m.*^{2}), which unite it with the lobe and stipes of the maxilla, and by a ligament which runs backwards to the top of the head. Of these muscles, one (figs. 5 and 7, *m.*) is inserted on the base of the lobe; two others, *m.*^{1} and *m.*^{2}, are inserted apparently within the stipes; by their contraction the fork is thrown forwards out of the mouth, or moved about. The backward running cord (*lig.*), which is double, is apparently neither muscular, nor the tendon of a muscle, but simply an elastic ligament to draw the fork back, and probably the membrane pierced by the fork aids in the same movement. The fork is still farther held in place by the flexor muscles of the stipes and lobe which pass behind it, and serve to bind it down against the lobe (fig. 6, *mm.*). The insertion of these muscles on the framework of the head can be seen in figure 4, *mm.*

The general shape of the fork, and its relations to the rest of the maxilla, can be seen from the figures and their explanations, better than described. It is hollow throughout, but the cavity tapers away toward the base, the contraction beginning at the point of union between the membrane and the fork. At the same time the surrounding wall grows thicker, while the wall of the distal portion is of equal thickness. On the inner portion, moreover, the wall becomes more delicate, and, except the immediate lining of the cavity, colorless.

In all the species of Psocidæ I have examined, the outer tine of the fork is longer than the inner. Usually the tips of the tines are truncate, and the surface thus formed is often deeply concave.

These insects are found on bark, old walls, fences, etc., and feed on decaying vegetable matter. Atropos, as is well known, lives on the paste in old books and boxes, as well as the specimens of entomological cabinets. Why they should need an oral structure so peculiar I do not know, but the mechanism of the fork indicates that it is used as a sort of pick.

In the maxilla we have recognized cardo, stipes and outer lobe, and one naturally asks if the fork is the homologue of the inner lobe of the typical maxilla, or an independent organ? At present I must incline to the latter view, although some may regard the absence of anything else to represent the inner lobe as sufficient evidence of their homology. But there is no articulation of any kind between the fork and the outer lobe, and the peculiarity of the muscular connections seem rather to favor the idea that the fork may represent an independent organ. Perhaps the study of the early stages of the Psocidæ may decide this question. We will now examine the other organs of the mouth.

The clypeus (figs. 1 and 2, *c*) is always remarkably large and vaulted, for the reception of a mass of muscles described below.

The upper lip in Psocus is transverse, rather large, with the free border well rounded. Two small hooks lie within this border, which, moreover, is doubled over upon itself, about one-third the width of the labium apart. They project backwards and inwards. In Atropos these hooks are more developed, and serve to retain the two lobes of the labium when placed against the labrum, while the labial palpi close against the labrum outside of the hooks, thus completely covering the mouth. Within, the labrum is furnished with a tuft of hairs above, as shown in fig. 2. A pair of long muscles which open the lip, are inserted one on either side of the median line near the base of the outer wall, and, running vertically to the cranium, are attached a little above the clypeus (figs. 2 and 9, *l. m.*).

The mandibles are very large and strong, outwardly presenting a triangular aspect, the posterior side being concave (fig. 1, *m.*). An inner view of the mandible (fig. 2) shows above a broad molar surface transversely ribbed. This surface contracts below into a sharp cutting edge, which curves backwards, forming a concavity in which the tip of the maxillary lobe lies. The cutting edge is slightly denticulated, as seen in fig. 8. The mandibles are moved by two enormous flexor muscles (figs. 2 and 8, *f. m.*), which fill the greater part of the cranium. They are made of a number of bundles radiating as usual from a chitinized tendon, which is inserted on the posterior upper edge of the mandible. The extensors are weak muscular bundles inserted on the middle of the upper outer edge of the mandible, and attached within the cheeks just below the eye (fig. 8, *e., m.*).

The maxillæ and mandibles occupy the lower half of the large oral cavity, which opens above into a thick-walled œsophagus. Below the opening of the œsophagus lies a bone, which may be fancifully likened to a lady's bonnet upside down (fig. 2, *œ. b.*, fig. 10); the high front lies along the oral cavity at about half way up; two narrow extensions, representing the bonnet strings, run forwards and upwards, embracing the œsophagus (fig. 9). The great bundles of short muscles filling the large vaulted clypeus (figs. 2 and 9, *c. m.*), are attached to the ends of these strings, and by their contraction close the œsophagus. Just below the "front" a fine duct (*l. d.*) opens, which is the common duct of a pair of lingual glands, presently to be described. Just below this bone there is a double elevated ridge covered with short hairs (fig. 10).

The lower lip (fig. 3) is composed of an oblong mentum (*m.*), bearing a larger labium (*lb.*) narrowed at the base, then expanding so as to have a bi-sinuate, almost S-shaped lateral outline; the lower edge bears two short, broad lobes, and two stumpy, one-jointed palpi (*l. p.*).[1] The labium in profile (figs. 1 and 2) is very thick, and the lower edge is divided into two narrow laminæ, while still a third lamina, well separated from the first two, forms the "tongue" (figs. 1–4, *t.*). Within the tongue lies a pair of peculiar organs which may be called the "lingual glands" (figs. 2 and 3, *l. g.*). These can be seen through the semitransparent mentum and labium, as in fig. 3, offering an irregular obovate outline. A short duct from the lower end of each gland leads into a common duct (*l. d.*), which opens in the œsophageal bone, as already described.

The ducts curve over the lower end of the glands and run up their posterior surface, to which they are soldered, nearly to the top. The line of the ducts, together with the lateral outlines, give the glands a three-cornered shape, somewhat like that of a butternut. A little triangular cap fits on the summit of each gland, and on it is inserted a suspensory muscle, the upper end of which is attached to the cranium (*g. m.*, figs. 2 and 3). The specimens at my command have not been fresh enough to study the histology of these organs, but they seem to be composed of an outer sack, with a thin, tough wall, which is light yellow, and has a slightly roughened or granular surface. The interior is filled with cells, and perhaps may be glandular. The excretory ducts are thick-walled and strengthened by circular threads, as is often the case with the salivary ducts of insects.[2]

These organs, as will be seen from this description, are very unlike the salivary glands of other insects, and are, whatever may be their

[1] With Westwood I regard these pieces as true palpi, and not as a second pair of labial lobes.

[2] The salivary ducts in most insects open by distinct apertures into the œsophagus, still they unite into a common duct in many Diptera and some Orthoptera. See Siebold, Anat. Invert. Siebold excepts only Mantis among the Orthoptera, but Blatta, Termes and the Acrydians, at least, must be added. The occurrence of salivary glands confined within the head is also unusual, but not without precedent.

office, as characteristic of the Psocidæ as the maxillary fork. Their sac-like structure would suggest that they were salivary reservoirs rather than glands, but I have not succeeded in finding any trace of other glandular organs, or of ducts which might lead to them.

Compared with Psocus, the mouth parts of the book-louse (Atropos) may be distinguished by their greater development. The clypeus is even more vaulted; the upper lip has been described above; the mandibles are stronger and much more denticulated; the maxillary fork is more slender, and very elongate, its base reaching far back into the head, and the tines are longer. The lobes of the labium are also slenderer and longer, and the labial palpi are longer and club-shaped. The lingual glands, from their yellow color, are very conspicuous when the head is examined by transmitted light. They are somewhat heart-shape instead of oval, and their ducts are rather longer than in Psocus. (See figs. 11 and 12.)

As the eyes of Atropos have never been described, I add a figure (13) to show their composition of seven simple ocelli, arranged in three rows. Six of these ocelli are round, and the seventh and uppermost elliptical.

I am indebted to the kindness of Mr. J. H. Emerton for the specimens of Psocus examined. They were collected at Hamilton, Mass., and are all pupal forms.

EXPLANATION OF PLATE 8.

Fig. 1. Head of Psocus in profile. *d.* The vaulted clypeus. *l.* Labrum. *m.* Mandible, behind which, and under the basal joint of the maxillary palpus, is seen the outer edge of the lobe of the maxilla, *mx.* *c.* The cardo, and *m. p.* the palpus of the maxilla. *f.* The "fork," lying over the tongue, *t.*, and fully extended; the base runs in behind the edge of the maxilla. *mn.* Mentum, and *lb.*, the labium with its one-jointed palpus, *l. p.*

Fig. 2. Longitudinal section through the middle of same head. *cl.* Clypeus. *l.* Labrum. *mand.* Mandible, the dotted line ends on the ribbed molar surface, which tapers beneath into the sharp cutting edge. *mx.* Maxilla. *t.* Tongue. *f.* Fork. *lb.* Labium, and *l. p.* its palpus. *m.* Mentum. *l. g.* Lingual gland, and *g. m.*, its suspensory muscle. *œ.* Œsophagus opening below into the oral cavity, at the base of which is the œsophagal bone, *œ.b.* *f.m.* Flexor muscle of the mandible, and *l. m.*, the muscle of the labrum. *c. m.* Muscles of the clypeus. *gl.* Supra-œsophageal ganglion.

Fig. 3. View of mentum, labium, etc., from behind. *m.* Mentum; *lb.*, labium, *l. p.*, one-jointed labial palpus, behind which one sees the tip of the fork, *f.* *c.* Cardo; *p.*, stipes having the four-jointed maxillary palpus; *mx.*, lobe. Through the mentum, can be seen the lingual glands, *l. g.*, with their duct *l. d.*

Fig. 4. View of the maxillæ, etc., from in front, as shown by a transverse section of the head. *mx.* Left maxilla, covering tip of right maxilla. *f.* Right fork, its base imbedded in muscles; *lig.* its retracting ligament. *ms.* Socket of the

right mandible; this part has been removed on the opposite side to show the base of the left maxilla, *c.* cardo, *p.* stipes. *t.* Tongue; *l. p.* labial palpus.

Fig. 5. View of the base of the right fork, *f.*, and its attachments seen from in front. *m.* The extensor muscle of the fork, and *lig.* its ligament; *mx.*, base of galea. *p.* stipes.

Fig. 6. View of same from behind, letters as in preceding figure, and *c*, cardo; *memb.*, elastic membrane connecting the fork with the lining of the mouth. *lb.* Labium.

The flexor muscles (*mm.*) of the stipes and galea are also seen, passing over the base of the fork.

Fig. 7. Galea and fork. *m.* Extensor muscle seen in the two previous figures; m^1 and m^2, other muscles inserted on the base of the fork, their outer attachments broken away; *lig.* ligament. (From another species of Psocus from Beverly.)

Fig. 8. Shows the muscles of the mandible with their attachments; *f. m.*, flexor, and *b. m.*, extensor. *m.* Molar surface of mandible.

Fig. 9. Transverse section of clypeus. *cl.* Clypeus, and *c. m.* its contained muscular bands with their tendons, *t*, attached to the œsophageal bone, *œ. b.*, on either side. *œ.* Space through which the œsophagus passes. *l. m.* Sections of the labial muscles, seen in fig. 2.

Fig. 10. Subœsophageal bone from in front. *l. d.* Duct of the lingual gland.

Figs. 11–13. Anatomy of Atropos.

Fig. 11. Labium and maxillary palpus.

Fig. 12. Lingual glands, œsophageal bone, and the fork.

Fig. 13. Eyes of Atropos.

Rhachura, a New Genus of Fossil Crustacea. By Samuel H. Scudder.

Mr. William Gurley has recently sent me from the black limestone of Danville, Ill., a curious crustacean, allied to Dithyrocaris, contained in a large kidney-shaped concretion. There are two separate fragments, one partially overlapping the other; one is more conspicuous than the other, consisting of the last three segments of an abdomen with a pair of lateral posterior appendages, all of a dull clay-color; while the other scarcely differs in color from the matrix, being only the impression of a portion of a carapace, the edge of which partially overlies one of the caudal appendages of the first mentioned fragment. Were it not for its caudal appendages the latter would resemble in a remarkable manner the thorax and abdomen of an insect, completely covered by its wings; for so closely do the lines of ornamentation upon the penultimate and antepenultimate segments resemble the veins of an insect's wings, that for a long time I was inclined to consider them such, notwithstanding the anomaly of the large exarticulate abdominal appendages. That it should be found in the same nodule with the carapace of a fluviatile or marine crustacean, seemed no more remarkable than the assemblage of animals associated in the nodule-bearing beds of Mazon Co. in the same State.

The penultimate and antepenultimate segments are of nearly equal breadth, the former nearly as long as broad, and quadrate; the latter is more than half as long again as broad, and also quadrate; the last segment is not preserved, but by the relation of the surrounding parts appears to have been triangular and nearly equiangular; attached to the outer sides of this segment are the caudal appendages, which diverge at a small angle; these appendages are slightly longer than the three terminal segments of the abdomen, straight, depressed, lamellate, tapering regularly beyond the middle and longitudinally sulcate throughout, as well as finely and obscurely striate near the tip; the extremities of both are broken, but were apparently produced to a fine point. There is no median spine, nor, to judge from the relation of the lateral spines at their base, and by comparison with the same parts in the trebly spined genera Ceratiocaris and Dithyrocaris, did one ever exist; if really bicaudate, this genus differs distinctly from any we know.

The most striking and interesting feature in this crustacean, however, lies in the nature and distribution of the lines of ornamentation upon the dorsal surface of the abdominal joints. So far as I am aware, the striation of the abdominal joints of these low and ancient Branchiopoda has always hitherto been found to take the form of imbricated lamellæ, and the lines thus formed run parallel, or nearly parallel, to one another. In Rhachura,[1] as the fossil from Illinois may be called, this is not the case, the markings being ordinary raised ridges, or, if in reverse, they appear as impressed lines or furrows, which branch more or less from one another. Their distribution on the antepenultimate segment is most remarkable; with the exception of one or two short and feeble lines next the outer edge, which run obliquely forward and parallel to each other, they either converge by running in a curving course toward the anterior outer embossed angles of the segment, or they join others which do so. At this angle, the principal lines, or those either made up of the union of several branches, or running independently to this point, do not quite meet, but lie side by side, just as do the principal veins of an insect's wing; so that these principal lines, with or without their branches, spreading in all directions over the half of the segment belonging to them, imitate, to an extraordinary degree, the branching or simple veins of an insect's wing. Moreover, just as in

[1] Derived from ῥάχος, οὐρά.

such low insects as have hitherto been found in carboniferous formations, the anal or posterior vein (which lies on the inner side when the wing is at rest) is always multivenose, and often occupies with its veinlets a large share of the wing, so here the innermost principal line is most numerously branched, and with its branches covers nearly a third of the segment. At first glance, however, these branches, which run transversely across the segment, appear to be continuous with those springing from the innermost line of the opposite side, which would be quite inconceivable in the wings of an insect; a close examination, however, shows that there is but a single one of these branches which actually traverses the segment; the others nearly meet, but interdigitate, and the break in the one might be judged to be invisible through the imperfection of preservation; so that the resemblance to an insect's wing is even more striking, and this circumstance long led me to maintain the possible insectean nature of the fossil. All the other lines, moreover, could be referred, without violence, to one or another of the principal veins of a wing, with the exception of those next the margin, whose origin could be supposed to be lost on the side of the fossil. Another feature rendered this theory more tenable; a microscopic comparison of the surfaces of the antepenultimate and penultimate segments of the abdomen showed a difference in texture, the former being marked by a very obscure and minute reticulation, which could not be seen on the latter; this difference was improbable, or at least unexpected, in two contiguous segments of a crustacean abdomen, but on the theory that the lines represented the veins of an insect's wing, seemed to indicate that the hind wing was membranous, and the fore wing more or less coriaceous in texture, as in Orthoptera. On the wing-hypothesis, however, the insect must have been extraordinary in character, even apart from the gigantic appendages of the abdomen. For, judging by the direction of the supposed veins, the front wings would then have covered only the segment which bore them, and would not have protected the hind wings; while the latter would have reached the tip of the abdomen with no plication of the anal area. The abdomen, also, notwithstanding it bore so enormous a pair of appendages, would have been shorter than the thorax, which in a comparatively slender insect would be altogether anomalous.

All doubts, however, concerning the real nature of the fossil were put to rest on the reception of some Devonian specimens of Dithyrocaris kindly lent me by Professor James Hall, and which he will describe under the name of *D. Neptuni.* These specimens, though gigantic beside Rhachura, show the same general features; the proportion of the different segments of the abdomen are almost identical; the lateral caudal appendages are essentially alike, although a median spine is added; the lines of ornamentation are of the same nature and have an equal distribution; they are in many cases branched; on the antepenultimate segment the anterior lines are transverse and with those of the opposite sides form curves, convex in front, while the posterior lines are longitudinal, just as in Rhachura; the general trend of all the lines on the penultimate segment is also the same, this segment differing in this respect from the antepenultimate to just the degree we find in the Illinois fossil. The much more numerous lines, however, do not, as in Rhachura, originate from the anterior outer angle of each segment, but from its whole outer margin, the greater part of them parallel to one another; but a curious resemblance to Rhachura again appears in the slight interdigitation of the lines of the opposite sides, which, as in Rhachura, appear at first glance to be continuous across the segment. These intimate resemblances show that the two animals were closely allied, but leave it no less surprising that mere marks of ornamentation should in so close a manner happen to resemble the neuration of an insect's wing. Owing to this resemblance it may bear the name of *Rhachura venosa.*

Having thus settled the affinities of this fragment, it seems probable that the impression of a dorsal shield in the same nodule belongs to the same individual. This would show that it possessed a carapace resembling that of Dithyrocaris in general form. It was, however, very broadly rounded in front, and its periphery had a broad, flat margin, which was covered, at least laterally, with very frequent, delicate but distinct, slightly incurved, uniform ridges, nearly parallel to the longitudinal axis of the body, and to one another. The specimen is too broken to show anything of the eyes or of any other feature excepting two low longitudinal ridges marked by a slight sharp carina, slightly curved, opening inward, one in the middle of either lateral half of the body.

Breadth of the carapace 50 mm.; breadth of its margin 5.5 mm.; greatest distance of lateral ridge from inner edge of margin — on one side, 10 mm.; on the other 8.5 mm. Length of abdominal fragment and appendages 48 mm.; of antepenultimate segment 7 mm.; breadth of same 9.5 mm.; length of penultimate segment 13 mm.;

breadth of same, posteriorly, 8.75 mm.; probable length of last segment 5 mm.; length of caudal appendages 26 mm.; breadth of same, at base, 3 mm.; in middle 2.5 mm.; at broken tip 1.2 mm.

The specimen, as I am informed by Mr. Gurley, comes from the bed marked as No. 14 in the section of the coal-measures of Vermilion County, given by Mr. Bradley in the Geology of Illinois, Vol. 4, pp. 244–47.

Plate 9, fig. 3, represents the abdominal fragment of the natural size; fig. 3, a, the same enlarged.

A Carboniferous Termes from Illinois. By Samuel H. Scudder.

An ironstone nodule from the coal measures of Vermilion Co., Ill., sent to me by Mr. Wm. Gurley, contains the remains of an insect, consisting of a pair of wings, apparently front wings, of opposite sides. The body between is crushed past all recognition, and fragments of the legs lying beneath the wings only show that they were slender. The wings, also, are only partially preserved, their bases being destroyed with the crushing of the body and their tips by extending beyond the edge of the nodule; more than half of each wing remains, however, comprising some of the more important parts, and showing that the insect belonged to the white ants. It is interesting from the fact that it is not only the first white ant found fossil in America, but is also the oldest known representative of that group of white ants whose wings are not reticulated, all the carboniferous white ants of Europe having net-veined wings. It seems to be more nearly allied to some of the tertiary Termitina described by Heer from Radoboj, and indeed to many living forms, than to other carboniferous Termitina, but it is much larger than its nearest allies. It may be called *Termes contusus.*

All the veins from the marginal to the interno-median inclusive, as far as they are traceable on the stone, are nearly straight and parallel; the upper three are also simple, and the scapular area is considerably and uniformly depressed; the externo-median vein is forked near the base of the wing, and the space included between the forks, as well as the externo-median area, is traversed by feeble inequidistant, straight or oblique, cross-veins. The interno-median vein traverses the middle of the wing, or runs scarcely above it, and emits from its lower border a large number of oblique veins, which run, often with a slightly irregular course, to the margin of the wing; in the fragment there are eight such veins on one wing and six on the other and more imperfect wing, in both cases about equidistant, but more regular and straighter on the left than on the right wing; in both, also, one of the secondary veins, and one only, arising shortly before the middle of the wing, is forked; on the left side close to its origin, on the right side near the middle of its course. Both borders are perfectly preserved on the right wing, showing it to be 10 mm. broad; the length of the longer fragment is 20 mm., and the probable length of the wing is about 35 mm.

General Meeting. February 6, 1878.

The President, Mr. T. T. Bouvé, in the chair. Fifty-one persons present.

Dr. W. G. Farlow gave an account of recent investigations on the nature of lichens.

The following paper was presented:—

Notes on Certain Species of New England Birds, with Additions to his Catalogue of the Birds of New England. By T. M. Brewer.

Polioptila cærulea Sclat. In December, 1836, more than forty-one years ago, I ventured, with a ?, to place this species on the list of the birds of Massachusetts, inferentially (Bost. Journ. Nat. Hist., I, p. 436). During all the years that had intervened, there had been no authentic evidence whatever showing that it was entitled to that place. Accordingly, in my catalogue this fact was stated, and its name transferred to the list of unauthenticated claimants. Since then it has been stated (Nutt. Bull., II, p. 20) that two specimens have been shot at Wauregan, Conn., by Mr. C. M. Carpenter, one in 1874, the other in 1876. Even if there were any doubts as to the certainty of the identification of these birds, there can be none in reference to an example observed by Mr. Arthur Smith, Nov. 18, 1877, at Chatham, Mass., and afterwards secured by Mr. Stephen Decatur (Nutt. Bull., III, p. 45).

Parus hudsonius Forster. In the July (1876) number of the Bulletin, Mr. B. Hart Merriam mentions the capture of this northern species in Connecticut, near New Haven, the most southern point of which there is any record. Mr. Merriam also calls attention to the overlooked fact that this species was taken in Brookline by S. E. Greene, Esq., in 1839. I found this species abundant in Mt. Desert during July and August, in 1877.

Lophophanes bicolor Bon. Mr. Merriam (Birds of Conn., p. 19) cites this species as a rare and accidental visitor to Connecticut, mentioning Lyme, Hartford, etc., as the places where its presence has given any tangible claim to be regarded as even accidentally a New England bird.

Thryothorus ludovicianus Bon. I am not prepared to admit the right of this bird to a place among the birds of New England. It has never been recorded from Connecticut, and has never been taken within our limits. Its presence may, however, be looked for if we can credit the correctness of the unauthenticated observations of H. D. Minot (Nutt. Bull., I, p. 76), who is confident he met with a pair near Boston in the summer of 1876.

Anthus ludovicianus Licht. This bird should have been given in my catalogue as migratory in spring and fall, as well as a winter visitant. I have taken several specimens in mid-winter (Feb.), and on Jan. 4, 1878, a small flock of this species was observed near Newburyport by Mr. R. L. Newcomb of Salem, an accurate and observing ornithologist. This species is also given by Mr. Boies as a winter visitant in corresponding latitudes in Michigan,[1] and by Mr. S. L. Willard[2] as occurring in winter near Utica, N. York.

Helminthophaga chrysoptera Cab. Farther investigations demonstrate this species to be a very rare and very local visitant in summer to this State. Only four nests, in all, have been taken here, and all of these have been in Newton (Nutt. Bull., I, p. 6). Mr. Merriam cites it as a rare summer resident in Connecticut, mentioning New Haven, Portland, Saybrook, Suffield and Hartford, as the localities.

Helminthophaga celata Bd. Since the publication of the catalogue a third and fourth example have been taken; one at Hollis,

[1] A. H. Boies. Cat. Birds S. Mich. Hudson, 1875.

[2] Birds of Central New York, Utica, 1877.

N. H. (Forest and Stream, VI, p. 354), by Mr. W. H. Fox, the other by Mr. Wm. Brewster, Oct. 2, 1876, at Concord, Mass. (Nutt. Bull., I, p. 95).

Dendroica Blackburniæ Bd. This bird was accidentally dropped out of the catalogue; it is migratory in spring and fall, and a summer resident from Connecticut northward, though not common in southern New England. Mr. Merriam (Birds of Ct., p. 16) thinks a few breed in that State. It certainly breeds in Massachusetts.

Dendroica cærulescens Bd. Rev. C. M. Jones (Nutt. Bull., I. p. 11) mentions this species as breeding in Eastford, in the north-east corner of Connecticut, in two instances.

Dendroica cærulea Bd. This western species is said to have been taken at Suffield, Conn. (Nutt. Bull., II, p. 21; Merriam's Birds of Conn., p. 16). I therefore venture to add this bird to my list, though not without much hesitation. It is not recorded by Mr. Lawrence as a bird of eastern New York, and must be purely accidental here.

Dendroica Auduboni Bd. Mr. A. M. Frazar (Nutt. Bull., II, p. 27) records the capture of a single example of this western species in Cambridge, Mass., Nov. 15, 1876. The occurrence, if authentic, must be regarded as exceptional and accidental.

Dendroica dominica Vieill. This species having been recorded by Mr. Lawrence as a bird of south-eastern New York, its occurrence in western and southern Connecticut was not unanticipated. Mr. Merriam (Birds of Conn., p. 19) cites it as a rare and accidental visitor, near New Haven, on the authority of Dr. E. L. R. Thompson, and near Hartford, on that of Dr. Daniel Crary.

Oporornis formosus Bd. Mr. Merriam (Birds of Conn., p. 23) cites this species as a rare summer visitant, on the authority of Mr. Shores of Suffield, and Mr. I. G. Ely of Lyme. This is the first authentic evidence on record of the kind.

Icteria virens Bon. As a rare summer visitant this bird can claim the addition of New Hampshire to its area of reproduction. A nest of this species, with four eggs, was taken by my young friend, C. A. Hawes, one of our active and progressive ornithologists, in North Conway, N. H., in the summer of 1877.

Myiodioctes mitratus Aud. Mr. Merriam, in his Birds of Conn. (pp. 25, 26), supplies some very valuable notes relative to this species, showing that instead of its being a rare summer resident, it is very abundant in various parts of that State, and has been traced almost to the Massachusetts line.

Pyranga ludoviciana Bon. I have recently seen in the rooms of a taxidermist in Lynn, a living example of this species captured in that town. It was taken January 20, during the snow storm, in an open cage set for the purpose with food to attract it. It had unquestionably been blown thither from the southwest by the tempest that had come to us from that quarter, and which had been making its approach for several days. Its presence on the sea-coast of Massachusetts in mid-winter, would otherwise be inexplicable. It evidently was not an escaped cage-bird. Its whole appearance showed it to be a wild bird. Its habitat is the western portions of the United States, from the Missouri Plains to the Pacific. In winter it migrates to Mexico and Central America.

Stelgidopteryx serripennis Aud. A single specimen taken at Suffield, Conn., by Mr. Shores, gives this a place in the New England list (Nutt. Bull., II, p. 21), and its abundance near the New York and Connecticut boundary at Riverdale (Birds of Conn., p. 31) seems to promise farther captures in western Connecticut.

Vireosylvia philadelphicus Cassin. Taken in Cambridge, Mass., by Mr. Wm. Brewster, Sept. 7, 1875 (Nutt. Bull., I, p. 19).

Vireosylvia gilvus Cassin. My catalogue has been criticized (Nutt. Bull., I, p. 73) because, as was erroneously alleged, it gave this species as "presumably of all New England," its existence in northern New England being denied by the writer. While the catalogue made no such claim, this species does exist more or less commonly, *in large villages*, as far north as the Canada line (Coventry, Vt.) at least, and beyond our borders as far to the northeast as Halifax (see Prof. I. R. Willis, Smithsonian Report, 1858, p. 282), and has been found as far to the northwest as Fort Simpson, latitude 64° north. Its northern limit, therefore, cannot even now be given with certainty.

Lanivireo flavifrons Vieill. The occurrence of this species in northern New England was not claimed in my catalogue, although erroneously so stated (Nutt. Bull., I, p. 73). Its capture by Mr. Deane at Ripogenus Lake (Nutt. Bull., I. p. 74), in northern Maine, Sept. 4, 1875, where it was a migrant from the north, seems to show that we do not yet know its most northern limit, and that it probably extends beyond our own boundaries.

Collurio excubitoroides Bd. Mr. Purdie reports the capture of a typical example of this species, taken at Cranston, R. I., by Mr. Jencks, the first instance on record (Nutt. Bull., II, p. 21).

Plectrophanes ornatus Towns. The capture of a male specimen of the western species is already recorded in our Proceedings, and the specimen itself is in the Society's collection. It was taken near Gloucester, Mass., July 28, 1876, by Mr. Chas. W. Townsend.

Passerculus princeps Maynard. The gradual accumulation of observations in reference to this new and rare species, point to its regular migratory appearance along the Atlantic coast of New England in considerable numbers. It has been taken at Point Lepreaux, N. B., by Mr. Brewster, April 11, 1876, and by Mr. C. Hart Merriam, near New Haven, Nov. 13, 1875 (Nutt. Bull., I, p. 52). Mr. C. N. Brown (Nutt. Bull., II, p. 27) claims to have met with this species Oct. 9, 1876, at Lake Umbagog, Me., but as he did not secure the evidence of the correctness of his determination, he may very easily have been mistaken.

Coturniculus Henslowi Bon. Mr. Charles F. Goodhue, of Webster, N. H., has found this species in several instances in that portion of New Hampshire, and in one instance secured its nest in Salisbury (Nutt. Bull., III, p. 39).

Ammodromus maritimus Sw. The area of this species has been ascertained to extend along the Massachusetts coast at least as far as Nahant.

Ammodromus caudacutus Sw. This species has been shown by recent testimony to extend, with irregular intervals, along the entire New England coast to the St. Croix, and northward as far as Prince Edward Island.

Chondestes grammaca Bon. The capture of a second specimen of this species in Massachusetts is recorded by Mr. Purdie (Nutt. Bull., III, p. 44), and is now in his collection. It was taken at Newtonville.

Junco oregonus Towns. Mr. Brewster records the capture of a single specimen of this far-western form in Watertown, Mass., March 25, 1874 (Nutt. Bull., I, p. 69). This is a very remarkable occurrence, and leads one to doubt as to what we may not now look for, in these regions.

Calamospiza bicolor Bon. The occurrence of the Lark Bunting in Massachusetts, as recorded by Mr. Allen (Nutt. Bull., III, p. 48), is one of the latest, as it is also one of the most extraordinary instances of erratic presence of a distant western form within our limits. It is the first instance of its capture east of the Mississippi River. The example was taken in Lynn, by Mr. Vickary, Dec. 5, 1877.

Corvus ossifragus Wilson. The capture of an undoubted example of this southern species is all that is needed to confirm its right to be regarded as an occasional visitant to New England, and this is probably only a question of time. It is not known to have ever been actually taken within our limits.

Milvulus forficatus Sw. Mr. Purdie (Nutt. Bull., II, p. 21) credits Mr. Carpenter with having procured at Wauregan, Conn., April, 1876, a specimen of this bird, an occurrence exceptional and accidental.

Empidonax acadicus Bd. After all, this bird must resume its place among the birds of New England, where Mr. Allen was the first to place it, and on whose verdict it was withdrawn. A specimen taken by Mr. E. I. Shores in Suffield, and fully identified as this bird, is cited by Mr. Merriam (Birds of Conn., p. 581).

Strix pratricola Bon. Mr. N. C. Brown (Nutt. Bull., II, p. 28) records the capture of an example of this species at Falmouth, Me., June 10, 1866.

Surnia ulula Linn. This species, a new form to North America, as well as to New England, claims a place in this list. A specimen was taken at Houlton, Me., in the fall of 1877, and is now in the collection of Mr. W. S. Brewer of this city.

Hierofalco labradora Aud. Mr. Cory (Nutt. Bull., II, p. 27) records the capture of this fine variety of the Gyrfalcon, on Breed's Island, Mass., in Oct., 1876. Mr. Boardman has also secured one or two specimens near Calais. I think that there are *three* distinct forms of *Hierofalco* of occasional occurrence in New England, but I am not prepared to designate them distinctively.

Buteo Swainsoni var. **insignatus** Cassin. Mr. Brewster records the capture of a second specimen of Swainson's Buzzard at Wayland, Mass., in September, 1876 (Nutt. Bull., III, p. 39). It was in a less melanistic plumage than the first.

Arquatella maritima Bd. This species is given in the catalogue as only a winter visitant, but the capture of an adult specimen at Chatham, Mass., by Mr. Wm. Jeffries of Boston, Sept. 8, 1877, suggests a modification of this record. This early presence on our coast, in mature dress, is probably exceptional.

Ancylocheilus subarquatus Kaup. The second recorded specimen of this species in New England is reported as having been shot in East Boston, May, 1876 (Nutt. Bull., I, p. 51), and another, subsequently recorded, in Scarboro, Me., Sept. 9, 1875, by Mr. Philip G. Brown (Nutt. Bull., II, p. 28).

Actidromas Bairdii Coues. This species has been taken at Upton, Me., by Mr. Wm. Brewster, Sept. 1, 1875 (Nutt. Bull., I, p. 19).

Machetes pugnax Gray. This species was included in my catalogue on the score of a single specimen taken by Mr. Wm. Brewster, on the Newburyport marshes, May 20, 1871. The same gentleman has since procured one, Sept. 8, at Upton, Me. (Nutt. Bull., I, p. 19).

Recurvirostra americana Gm. Mr. Merriam gives this as a bird of Conn. (Birds of Conn., p. 103), on the authority of Josiah G. Ely. It had been taken in a net near Saybrook, in 1871. This is the only instance of its capture within our limits that is on record, all others having been extra-limital or without particulars.

Rallus crepitans Gm. The New England collection of this Society possesses a fine specimen of this rail, taken in Boston Harbor in May, 1876, and presented by Mr. Ross. This species is known to breed in southwestern Connecticut, but this is the only known instance of its capture in Massachusetts.

Rallus elegans Aud. The cabinet of Mr. Willard S. Brewer possesses a fine specimen of this species, shot in Nahant in the spring of 1876. There was no previous record of this bird for New England, except West Haven, Conn.

Porzana jamaicensis Cassin. Mr. Purdie reports this bird as procured in Plymouth, Mass. It was previously recorded as found in Connecticut, where it appears to be not at all uncommon.

Ibis alba Vieill. This species is recorded as a bird of Connecticut by Mr. Merriam (*ibid.*, p. 110) on the strength of a single specimen met with by Mr. G. B. Grinnell within ten miles of New Haven. Although the bird was not captured, it appears to have been so well identified that there can be no well-founded doubts as to its specific reality. It was observed May 23, 1875 (Am. Nat., IX, 470).

Bernicla leucopsis Linn. A head and neck of the Barnacle Goose is now in the possession of my young friends, Mr. Russell Hooper and Mr. Outram Bangs, of Boston. These were all that was unplucked of a goose found in the Boston market this winter, and which had been shot in Marshfield, Vt. From the locality it is not probable that the bird had escaped from confinement, and therefore this species may once more take its place among the many accidental visitors to New England.

Tachypetes aquilus Vieill. Mr. Merriam, in his Birds of Connecticut (p. 131), records the capture of a single specimen of this tropical form at Faulkner's Island in the autumn of 1859. It is also recorded by Mr. Grinnell (Am. Nat., IX, p. 470).

Sterna fuliginosa Gm. Mr. Purdie mentions (Nutt. Bull., II, p. 22), as in the collection of a Mr. Clark of Saybrook, Conn., an example of this species picked up at the steam-boat wharf of that place. And Mr. Deane (Nutt. Bull., II, p. 27) also reports the capture of one of these species near Lawrence, Mass., Oct. 29, 1876. Three birds of this species were observed near Chatham, Mass., but were not secured, by Mr. Wm. Jeffries, in Sept., 1877. These are the only authentic mention of the presence of this species on our coast that have come within my knowledge.

The species mentioned above as found, with positive certainty, within the limits of New England are as follows:—

1. **Polioptila cærulea** Sclat. Very rare and accidental; Connecticut and Massachusetts.
2. **Lophophanes bicolor** Bon. Accidental; Conn. in winter.
3. **Dendroica Blackburniæ** Bd. Common throughout New England, a few breeding in Connecticut and Massachusetts, and more abundantly northward; migratory in spring and fall.
4. **Dendroica cærulea** Bd. Conn. (?)
5. **Dendroica Audubonii** Bd. Accidental; Cambridge, Mass.
6. **Dendroica dominica** Vieill. Conn.; rare.
7. **Oporornis formosus** Bd. Conn.; rare.
8. **Pyranga ludoviciana** Bon. Mass.; accidental.
9. **Stelgidopteryx serripennis** Aud. Southwestern Conn.
10. **Collyrio excubitoroides** Bd. Very rare; Rhode Island.
11. **Plectrophanes ornatus** Towns. Accidental; Mass.
12. **Junco oregonus** Towns. Accidental; Mass.
13. **Calamospiza bicolor** Bon. Accidental; Mass.
14. **Milvulus forficatus** Sw. Accidental; Mass.
15. **Empidonax acadicus** Bd. Rare; Western Conn.
16. **Surnia ulula** Linn. Probably rare; Me.
17. **Recurvirostra americana** Gm. Conn.; rare.
18. **Ibis alba** Vieill. Conn.; probably accidental.
19. **Bernicla leucopsis** Linn. Vermont; accidental.

20. Tachypetes aquilus Vieill. Conn.; accidental.

21. Sterna fuliginosa Gm. Conn., Mass.; very rare, probably accidental.

Taking from the previous catalogue *Sterna portlandica* Ridgway, which is only a synonym for *St. macroura*, there will remain three hundred and thirty-five birds given in that list. With the above additions, we have in all three hundred and fifty-six recognized forms that have been taken within our limits. To show the zeal and industry with which the knowledge of our fauna has been studied and extended, it needs only to be mentioned that the list now contains the names of not less than forty species not positively known to occur in New England prior to 1874, although the occasional appearance of some five or six had been looked for by several prophetic observers. This does not include seven species whose names had been borne on previous lists, but without any recorded evidence of their right to be there. It moreover includes two or three forms that some do not recognize as of specific value, and one whose very existence as a species appears to call for more evidence before its reality can be fully admitted.

General Meeting. February 20, 1878.

The President, Mr. T. T. Bouvé, in the chair. Thirty-four persons present.

Mr. C. S. Minot gave a sketch of the histology of the grasshopper.

The following papers were read: —

Notes on the Petrography of Quincy and Rockport. By M. E. Wadsworth.

The stone that is quarried in Quincy for building purposes, is mainly a dark bluish and reddish gray syenite.[1] Its constituent feldspar varies in color, being of bluish, brownish, reddish, or ash gray shades, and commonly occurs in simple twins. The quartz is color-

[1] See Memoirs American Academy, 1st Series, Vol. III, page 137, and Vol. IV, page 205.

less to dark, almost black, and contains macroscopic inclusions of hornblende. The hornblende is black or dark green in color, cleavable, and fuses easily (F. 3+) with intumescence to a black, magnetic, blebby mass. The relative abundance of these minerals is in the order in which they are named, but the feldspar largely predominates. Through the quarries, reddish and grayish fine grained bands of syenite occur. Minute and almost microscopic crystals of danalite are found in some parts of the rock; and to this mineral is doubtless owing the peculiar appearance of the walls in the main hall of the Custom House in Boston.

The sections of the Quincy syenite that I have examined, were made by me considerably over a year ago, for comparison with the Rockport granite, but the publication of the results has been delayed in order to make further observations in the field and laboratory; finding, however, that the more important work upon which I am now engaged will prevent my recurring to the subject for some time to come, it seems best to present these preliminary notes and leave the remainder of the work for a future time. The sections examined were made principally from specimens obtained from Mitchell's Quarry, Payne's Hill, Quincy, and from the stone employed in the construction of the east wing of Gore Hall, Harvard University.

In the thin section the hornblende is of a blue, green, or brown color, and has suffered a change to chlorite in many places. Its edges are very ragged and fringed, having deep sinuses filled with quartz and feldspar. Some sections show particles of hornblende, extending, like boulder trains, one after the other, in wavy lines through the feldspar, from points of the main hornblende mass. The hornblende appears to have been first formed, and then partially dissolved and rent asunder by the magma, before it (the magma) crystallized.

The feldspar is mainly orthoclase, but here and there patches of plagioclase are seen. It is much altered, and in places partially replaced by quartz. The feldspar is full of inclusions (glass cavities, etc.), besides containing numerous fragments and microlites of hornblende. The inclusions, excepting the hornblende, are generally arranged in parallel bands, oblique to the line of twining.

The quartz contains numerous fluid cavities of relatively large size inclosing bubbles, which in the smaller cavities show the usual unceasing motion. The microlites of hornblende in the quartz are larger and better crystallized than in the feldspar, but are not as numerous. The finer bands in the Quincy syenite are made up of intimate mixtures of quartz, orthoclase, and plagioclase, holding flocculent hornblende.

The statements made regarding the mineral composition of the Rockport stone differ in the various papers which touch upon this subject. For instance, President Hitchcock wrote[1]: — "SIENITE: *Feldspar, Quartz, and Hornblende.* This variety embraces nearly all the sienite in the state that is employed for architectural purposes, including the quarries at Quincy and those on Cape Ann. Feldspar is the most abundant ingredient. This is foliated, and commonly of a grayish, bluish, or yellowish color. A hyaline quartz, varying in color from quite light to quite dark gray, is very uniformly mixed with the feldspar, so as to exhibit homogeneousness in the midst of variety. In general, the hornblende, which is black, is very sparingly disseminated, and hand specimens often contain not a particle. Indeed, over extensive tracts I have sometimes not met with any."

Rev. Stillman Barden, speaking of Rockport,[2] says: — "This is a region of hard, stern granite; unpoetical, perhaps, but full of interest to the mineralogist. The rock seems like sienite, from the very dark hue of the mica, but is yet a true granite with all the value of that eldest of all the rocks." Again he says[3]: — "In the extensive quarries worked by Eames and Co., can be seen some of the best and purest granite in the country; there is almost an entire absence of hornblende. Granite contains quartz, feldspar and mica — sienite, quartz, feldspar and hornblende; frequently the four ingredients are found combined together, viz.: quartz, feldspar, mica and hornblende; hence the rock of this region may be termed sienitic granite."

Professor J. P. Cooke writes[4]: "The mica which is associated with cryophyllite at Rockport (or as we should rather say, with which cryophyllite is associated, for cryophyllite is the subordinate species), is an iron mica of the species lepidomelane. This is the common mica of the great granite ledges which form the extremity of Cape Ann. In the granite itself, however, it occurs only in small flakes, forming a very small proportion of the whole mass; but in the numerous veins which intersect the rock, lepidomelane is found in

[1] Geology of Massachusetts, Final Report, 1841, page 668.
[2] Proceedings of the Essex Institute, 1862, Vol. III, page 205.
[3] Proceedings of the Essex Institute, 1863, Vol. III, page 231.
[4] American Journal of Science, II Ser., Vol. XLIII, 1867, page 222.

crystals of considerable size, and sometimes in plates several inches in diameter. The vein, from which most of the best specimens have been taken, is an offshoot of one of the great trap dikes which cross the Cape from north to south nearly parallel to each other, and consists chiefly of massive quartz and feldspar almost completely segregated, the quartz lining the lower wall, while the feldspar lines the hanging wall of the vein."

Dr. T. Sterry Hunt also says[1]: — "The hornblendic granites of Gloucester, Salem, and Quincy, Massachusetts, seem also, from their lithological characters, to belong to the class of exotic or true eruptive granites." Again[2]: — "The fine green feldspar of Cape Ann, Massachusetts, and the micas, cryophyllite and lepidomelane, with zircon, described by Professor Cooke, from the same region, occur in veins in the hornblendic granites of that locality."

The last writer upon the geology of this region, Mr. W. O. Crosby, makes the following statement[3]: — "The typical hornblendic granite of this region, as shown at the quarries in Quincy, Rockport, and other places, is a coarsely crystalline aggregate of orthoclase, quartz, and hornblende. The hornblende is usually small in amount, and the rock frequently passes, through the disappearance of hornblende, into binary granite. The feldspar is usually grayish or bluish, though red and green tints are frequently met with. It is worthy of note that this rock is destitute of mica, or at least its presence is a very rare occurrence. This typical granite frequently passes into finer grained varieties, which, when hornblende is absent, pass through eurite into felsite. The more hornblendic varieties are usually fine grained; and the increase of hornblende is attended by a diminution of quartz, so that the rock exhibits, through the entire absence of quartz, frequent passages into diorite."

It seems strange that experienced observers, who have all personally examined this region, should make so diverse statements, especially, as at least ninety-five per cent. of the stone brought from Rockport to this vicinity, for architectural purposes, is micaceous and destitute of hornblende. Examples can be seen in the basement walls of the building of this Society, and in those of the Massachusetts Institute of Technology, or upon almost any street in Boston. In Cambridge, Boylston Hall will serve as a typical example of

[1] Chemical and Geological Essays, page 188.
[2] Chemical and Geological Essays, page 200.
[3] Report on the Geological Map of Massachusetts, page 13. 1876.

Rockport granite, standing side by side with the Quincy syenite of Gore Hall.

In attempting to account for this diversity of statement, very many of the buildings in Boston constructed of the Rockport stone, were examined: and several thin sections were made (at the time when those of the Quincy syenite were prepared) of Rockport stone that could be procured from the stone yards in this vicinity. All the sections were of granite, and to the best of my recollection, all the buildings examined were of the same material, except part of the the west side of the Beacon Hill reservoir, where it is partially hornblendic, and the Boston Post Office.

Last autumn I was able to visit Rockport twice, for several hours each time. My examinations show that both the syenite and granite exist in Rockport and Gloucester; but the latter is the rock principally quarried. The places examined were the cuttings along the railroad from Gloucester to Rockport, and from Rockport northward beyond Pigeon Cove. I am indebted to Mr. J. H. Huntington, of the New Hampshire Geological Survey, for thin sections of the specimens of the syenite, granite, and trap obtained at several of these localities.

Near Cedar St., Gloucester, the rock is a syenite, while about one-fourth of a mile beyond, at the Rockport road bridge over the railroad, it is a granite, both of a coarse and fine grained character. Three trap dikes occur here, running respectively north 10° east, north 10° west, and north 60° east, but are somewhat irregular in direction. Beyond this locality, towards Rockport, the syenite predominates, although granite was seen in several places; of a pale red color at one locality.

North of Rockport the rock is syenite, which extends nearly to the wharf of the Rockport Granite Company, where a gradual passage into granite takes place; the rock along the line of passage contains both mica and hornblende. North of Pigeon Hill the rock again becomes syenite, but a very cursory examination, however, was made there. On account of the blackness of the mica, it often requires careful examination, in the field, to separate it positively from the hornblende, and I have found the test of hardness the most convenient under the circumstances, for the cleavage is often not evident. As far as my observation has gone, there is no real distinction between the syenite and granite, but they are geologically one and the same rock. The granite, however, appears to run in a band across the Cape, yet the whole subject needs further examination.

Numerous dikes occur in this region, some narrow and fine grained, others wide and more or less porphyritic. The directions taken by these dikes are various (north and south, north 70° east, north 40° west, etc.), following the jointing of the rock. The dikes have sometimes left one fissure in the rock for another, but in general they follow one of two directions making two sets of dikes, one taking mainly a north and south direction, and the other an east and west course. Their general course is like to that of similar dikes in the vicinity of Boston; and as is the case there, the east and west dikes are the older. The Rockport building granite is composed of grayish white feldspar, colorless quartz, quite abundant, and black mica (lepidomelane, Cooke, annite, Dana), sometimes with cryophyllite and minute crystals of danalite.

The mica, in the thin section, shows an irregular black mass, blue and dark brown on the thinest parts, accompanied with bundles of brown needle-shaped crystals, and plates that have the microscopic characters of biotite. Whatever the mica may be in the veins, it does not appear to be homogeneous in the rock itself. It occurs in very irregular shapes, in shreds and patches, with fringed and jagged edges. Flakes of the mica are scattered through the feldspar, and to some extent through the quartz. The feldspar is orthoclase, somewhat decomposed, full of inclusions, in general characters similar to that of the Quincy syenite, and in similar twins. The quartz is full of fluid inclusions, with their movable and moving bubbles. These inclusions are often arranged in bands and star-like forms. The quartz is more abundant than in the Quincy syenite.

The hornblende of the Rockport syenite is of shades of blue and green, with spots of reddish brown, and is in the same irregular masses as the mica; the feldspar and quartz have the same characters as that of the granite, but fuller, it may be, of inclusions. In the syenite of Cedar St., Gloucester, the hornblende is of similar character, and the feldspar contains numerous inclusions of hornblende, similar to those in the feldspar of the Quincy syenite. The quartz, besides its fluid inclusions, contains also many colorless microlites. The fine grained granite one-fourth of a mile north of Gloucester, is composed of quartz, feldspar, and a brown mica of the same microscopic characters as biotite. This mica has in places a bluish shade of color.

The dike at this locality, running north 60° east, is composed of a fine crystalline, dark greenish gray rock, which in the thin section is seen to be composed of plagioclase, light brown augite, magnetite, and viridite or chlorite. Its structure is basaltic, and it is evidently an altered basalt, but has now the mineral composition of a diabase. The dike at the same locality running north 10° east, is a dark gray compact melaphyr, showing in the thin section that it is composed of augite, plagioclase, magnetite and viridite, with traces of olivine. A single crystal of hornblende was seen in the section. This rock has a basaltic structure, and more the characters of a melaphyr than those of a diabase. The rock of the dike in this locality, which runs north 10° west, is of a dark gray color, with grayish white streaks running through it, arising from the decomposition of its feldspar. It is finely crystalline, and in the thin section shows great alteration. It is composed of feldspar with opacite, viridite, and other products of alteration.

Thin sections were made of material obtained both from the centre and the edge of one of the large north and south dikes, in the principal quarry of the Rockport Granite Company. The exterior of the dike is a compact grayish black rock, finely crystalline, and made up of augite, plagioclase, magnetite, and viridite; while the centre of the same dike is composed of a dark gray ground mass, porphyritically inclosing crystals of plagioclase, well striated.

In the thin section it is seen to be composed of plagioclase, magnetite, opacite, and a green fibrous product of decomposition, somewhat dichroic, and doubtless of hornblendic character. In blocks of the syenite, used in a wall at the side of the railroad track, about a quarter of a mile south of the Rockport depot, narrow dikes are seen, varying from a few inches to less than an eighth of an inch in width. A thin section was made, showing the syenite on both sides of a dike about a third of an inch wide. The dike is composed of a brown tachylitic glass, showing flow structure, and curving around the few inclosed crystals, which are mainly feldspar and magnetite. The quartz of the adjoining syenite is full of colorless microlites.

The examination of the thin sections, so far as it has been carried, would not show any essential difference between the syenite of Quincy and that of Rockport, but would rather indicate that they are of the same age, as has been supposed heretofore. The syenite, in the thin section, has a similar character and structure to that of the granite, so much so, that in some cases, especially in the thicker sections, it is quite difficult to distinguish between them. The microscopic study, therefore, strengthens the conclusions drawn from macroscopic observations. It may not be amiss to remark that, in the thin section, the Rockport granite is a much tougher rock than the Quincy syenite, and can be ground much thinner without breaking.

The dikes examined were all of a basaltic character, and the east and west, or older ones, will in general be classed as diabases, and the younger as melaphyrs; but the distinction between them is much less marked than is the case in the same rocks in the vicinity of Boston. These old dike rocks are in many cases much less altered than are some of the recent basalts of California. Most of the boulders in the parts of Rockport that were visited, are local, and in a great measure nearly *in situ*, as can be readily seen upon almost any part of the Cape.

On two New Species of the Genus Pachylus Koch, from the Argentine Republic. By Prof. H. Weyenbergh, Ph.D.

Pachylus mesopotamogalis m. *P. corpore sphaero-triangulari, prope subovato; cephalothorace margine laterali irregulariter granoso; mandibulis et palpis ferrrugineo-fuscis; intra oculos nec non in ultimo cephalothoracis segmento spina acuta: omnium prope spinarum apicibus claris; femoribus spinosissimis et curvatis; articulationibus pedium omnium circulo claro ornatis; tarsis 1i paris ex 6, 2i ex 8, 3ii et 4i ex 6 ariiculis constantibus.*

♂. The general color is sepia. The palpi light brown, six-jointed, with a sharp nail on the last joint; three spines on the inner side of the penultimate, and four on the same side of the following joint. The posterior spine of each joint is the largest, regularly decreasing in size toward the apex of the palp. The mandibles are also light brown or yellow; the outer (movable) blade of the pincers of the mandibles is stronger than the inner.

The first three legs are sepia-colored, a little warty, but these warts are very small. The tarsi are a little lighter, especially those of the fourth pair. The trochanters are light brown, and around every articulation of the leg is observed a circle of the same color. The eye-tubercle is distinct, and a sharp black spine with a light brown tip lies between the two eyes. This part of the cephalothorax is dark; the following part, consisting apparently of five segments, is lighter, and a longitudinal impression in the middle of the back divides it into lateral halves, so that the first of these five segments is more or less polygonal in form on either side; the whole being surrounded by a thick border more or less irregularly nacreous. On every segment are also some nacreous tubercles; three or four on the first and second segment, more or less paired; on either side of the third are: first two large ones, then two small ones, and then again two larger ones, forming together an irregular transverse row; on the fourth are only two such pearls on either side, and on the fifth four or five small ones, placed a little more outwardly, and also forming a row. In the middle of this segment is observed a spine directed backwards, and of the same size as the spine between the eyes; on either side of this spine is another small one, occupying the place of the first pearl of the transverse row mentioned. The position of these pearls does not seem to be always symmetrical.

The body is nearly triangular in form, or better, sphaero-triangular, and accords in its main features with *P. granulatus* Koch,[1] although in that species there are more pearls, arranged in a different position; so, too, the spines of the last segment are not observed in Koch's species, which is smaller than our *P. mesopotamogalis.*

The abdominal segments are small, with yellow borders, and partially cover one another. On the posterior border of the dorsal face of the first two of these segments are seven or eight pearls. The genital organs form a small knot next the inside of the coxæ of the hind leg. The front portion of the ventral face is lighter than the hinder part, occupied by the thick coxæ; this part is brown. Around the mouth the color is very light. Seen from the under side, the general form is more triangular than from above.

Having spoken already of the first three legs, I will describe in even greater detail the large hind legs. The coxæ are very thick and smooth, with a kind of keel between them on the ventral side, colored brown, and on the back side black, with a thick, bifurcated spine or knot upon the articulation with the trochanter, to which corresponds a smaller spine with only one point on the trochanter itself. The trochanter is short, thick and black, with a yellow ring at either extremity, confluent on the inner side; at the upper end (ventral face) is a pair of small spines, or rather, bristles. The

[1] Cf. Koch u Kollar. Die Arachn. T. VI., p. 20, tab. CCXXI., fig. 548. — Koch. Uebers. d. Arachn. Syst. II, p. 13. — Guérin. Icon. R. Anim.-Apt., p. 12, pl. 4, fig. 5 (*Gonyleptes curvipes*). — Gervais in: Walckénaer. Apt. T. III, p. 104. pl. 46, fig. 1. — Gay. Hist. fisica y polit. de Chile. Zool. T. IV, p. 20. Atlas. Araen. lam. I, fig. 5, 6. (*Gonyleptes chilensis*). — Thorell. Sobre alg. araen. d. l. Republ. Argent. in: Periodico Zoolog. Argent. T. II., p. 211. — Td. Boletin d. l. Acad. Nac. Argent. T. 2, p. 265.

femur is strongly spined and warty; there is a great, blunt spine on the articulating angle, near the trochanter, and on the outside two little spines, followed by a larger one with a sharp point; a spine similar to the last occurs at a little distance from it on the same side, and is followed again by two small spines, or sometimes only by one; on the articulation with the tibia is observed a larger spine with curved point, resembling a cock's spur, having a small spine at its base.

All these spines have light yellow points, with black bases. On the middle of the posterior side of the femur there is a single wholly black spur or spine. On account of all these spines, the general form of the femur is very irregular and angular, but it is not stout when compared with the coxa and trochanter; above, it is a little curved in the form of an S, and the color is black, save the yellow rings at either articulating end. The two parts of the tibia also are a little warty, black, and ringed with a lighter color at the articulations; the first part is short, tumid, swollen; and therefore roundish, with three small spines on the inner side. The second piece of the tibia is long, with three pretty long and sharp spines on the inner side, and a pair of small ones at the inferior articulation; all these spines have light points. The following joint of the leg, the first joint of the tarsus, is slender, regularly cylindric, unspined, and about as long as the two pieces of the tibia together; its colour is yellowish. The other joints of the tarsus are moniliform and yellowish; the last joint is a little longer than the others, delicately hairy, and ends in two nails or little claws. What I have said of the hind tarsi also applies more or less to all the other tarsi, excepting that the others have only a single claw.

The size, without counting the appendages, and with the abdominal segments contracted from preservation in alcohol, is 11 to 12 millimeters; the greatest breadth, measured over the bases of the coxæ, is about 10 millimeters.

♀. The body is smaller and more oval; the spines of the hind leg are not developed; the longitudinal impression on the five apparent segments of the cephalothorax is indistinct, and the spine on the last one is very small; about ten pearls may be observed on either side; the abdominal segments seem to be simple continuations of the former, differing from them only by the fact that the thick border of the cephalothorax is not continued on their side; the abdomen is not so contracted by the sliding of the segments over one another as in the male, and present on their hind borders more pearls than in the male. The sepia color of the whole body is generally a little darker, especially on the ventral face.

My friend Prof. Dr. P. G. Lorentz sent me several specimens of this species, found by him under stones in the Argentine province of Entrerios, called generally "the Argentine Mesopotamia," on which account I have given it this name.

Pachylus Gouldii m. *P. corpore prope triangulari, colore nigro, item prima tarsium articulatione, nec apicibus spinarum claris; intra oculos, non in ultimo segmento cephalothoracis spina; femoribus paullo curvatis et vix spinosis. Circulus clarus pedium articulationibus abest. Tarsi 1i et 2i paris ex 6, 3ii et 4i ex 7 articulis constantes.*

♀. This species is a little larger and darker colored than the former, its color being almost completely black. The form of the body is more triangular, the abdominal segments being entirely withdrawn; as this is not the case in the former species, it presents a more oval form, approximating to a sphæroid triangle. The palpi are a little more armed, and their color and that of the mandibles is black or dark brown; the legs have the same color, only the tarsi are lighter, although the large first joint is also black. The spines do not present yellow points, and the legs generally are very warty.

On each segment are observed more pearls than in the former species, and they are placed in regular rows; on the first polygonal false segment two such rows are seen. Between the eyes is a spine, as in the former species, but none occur on the last segment of the cephalothorax, while on the contrary the pearls on this segment are here a little more elevated and sharper, the pearls on the back side of the abdominal segments becoming little spines.

The femora are not so curved in the form of an S, nor so stout, and their spines are much weaker. The light rings around the articulations of the legs are absent, only the first piece of the tibia presenting still a trace of them.

The thick border of the cephalothorax is regularly nacreous, and this species more closely resembles in the general form of the body *P. acanthops* Gerv.

I possess only the female given to me by my friend Prof. Dr. B. A. Gould, who captured it at Cordova.

I am now acquainted with various species of this family and of this genus; but this is the first time I have had in my hands animals of this kind, enabling me to compare them with the fossil specimen that some years since I described from the lithographic stones of Solenhofen.[1]

In the supplementary notes mentioned below I have said that this fossil of Solenhofen, *Hasseltides primigenius* Weyenb., belongs to the small order of the Phalangita, which in the descending system falls between the Pedipalpi (scorpions) and Araneidea (true spiders), but I left it undecided whether it belonged to the family Opilionidae, to which belong the two other species known from the secondary rocks of Solenhofen (*Phalangites priscus* Roth and *Ph. cursor* Roth), or to the family Gonyleptidae. Now, however, I am convinced that the *Hasseltides primigenius* belongs to the family Gonyleptidae, and is allied to the genus Pachylus.

Cordova (Argentine Republic), 1877.

Section of Entomology. February 27, 1878.

Mr. G. Dimmock in the chair. Thirteen persons present.

The following paper was read: —

TWO INTERESTING AMERICAN DIPTERA. BY EDWARD BURGESS.

I have had in my collection for several years an interesting fly, taken in Springfield by Mr. George Dimmock, the true position of which among those families of Diptera grouped about the Tabanidæ, and characterized by the complete marginal vein of the wing and a pulvilliform empodium, has been very doubtful. Like the genus Arthropeas of Loew,[2] this form presents affinities in several directions, and, like it, shows the necessity of a future remodelling of the groups in question. Arthropeas was placed by Loew provisionally among the Xylophagidæ, and if we accept the families as they stand and consider the antennal structure to be of the highest importance, it must undoubtedly be referred to this family. Baron Osten Sacken, whose opinions on the dipterological system are entitled to the high-

[1] Cf. Weyenbergh. Sur les insectes fossiles du calcaire lithograph. de la Bavière, etc., in: Archiv. du Musée Teyler à Harlem, T. II. (1869), p. 247.

Supplementary notes to this monograph I have given in the same "Archives," T. III, and in the "Periodico Zoologico Argentino." T. I. (1874).

[2] Ent. Zeit., Stettin, XI, 304.

est consideration, writes me that he is inclined to subordinate the structure of the antennæ in Arthropeas to its general *habitus*, which is undoubtedly that of a Leptid; for he argues that there is no more reason for regarding this organ as so constant in the Leptidæ, than in the Xylophagidæ, Stratiomydæ, etc.

If we admit this genus to a place among the Leptidæ, perhaps the doubtful form I am about to describe as *Glutops singularis*, would most naturally follow, although it is certainly by no means so closely related to this family as is the former genus.

Besides the difference in antennal structure, Glutops diverges from the Leptidæ in the stoutness of the body, the great breadth of the head, and the retraction within the abdomen of the last segment, so that the abdomen is apparently only six-ringed, and shorter and wider than in the Leptidæ. The wings are also narrower. In all the above particulars, except the narrowness of the wing, it differs from the Xylophagidæ, and also in its hairiness, the contact of the eyes[1] in the male, and the spurless fore tibiæ. From the Tabanidæ, which it somewhat approaches in habitus,[2] and in the shape of the eyes, the small tegmina distinguish it readily, and probably the oral structure, which I cannot determine.

The nearest allies of Glutops among the Leptidæ, are the species of Symphoromyia Frauenf., where the head is broad and the face short, and the body is sparsely clothed with long fine hair. Among these species, too, the antennæ diverge in structure from the typical Leptidæ.

Glutops[3] gen. nov.

Body stout, musciform, clothed with long fine hair. Head broader than the thorax; eyes naked, broader than high and contiguous over the whole front (♂). Antennæ approximate at the base, longer than head, first and second joints long, with long bristles above. Third joint 8-annulate, first annulus long. Face projecting into two rounded conical protuberances, thickly covered with long hair. Palpi long, decurved, filiform; proboscis with thick labia and four? bristles. Wings narrow, marginal vein encompassing the whole border. Third vein furcate, two intercalary veins present, fourth posterior and the

[1] If we regard the Cœnomyidæ as a distinct family.

[2] Compare especially the genus Pronopes Loew (Dipt. Sud-Afrika); it is widely separated, however, from this form, even disregarding the structure of the mouth.

[3] From γλουτός, rump, and ὤψ, face. Name suggested by Baron Osten Sacken in allusion to the shape of the face.

anal cell open. Tegulæ moderate. Scutel rather small, unarmed. Legs short and stout, fore tibiæ without, and middle and hind tibiæ with, spurs. Empodium pulvilliform. Abdomen oval, with six visible segments (♂) and protruding genitalia.

Glutops may at once be distinguished by its Musca-like body, large head, antennal structure, and the conical prominences of the face. The structure of the mouth parts is obscured by the thick curtain of hair falling from the face and cheeks.

Glutops singularis sp. nov. Plate 9, figs. 2, a, b, c and d.

♂. Bluish gray; eyes, base of antennæ, mouth parts, and legs ferrugineous. Thorax with four narrow, dusky, longitudinal stripes. Wings dusky, the cross-veins clouded, a rusty stigmatic stripe. Long. corp., 8 mm. Long. alæ, 8.5 mm.

Eyes brown, transverse, contiguous from ocellar tubercle nearly to base of antennæ. First two joints of antennæ ferruginous, long, clavate; first joint one-third longer than the second; both joints have long bristles or hairs, especially above. Third joint one-half longer than the first two together, 8-annulate. First annulus nearly half as long as the rest together, and stouter, slightly clavate, constricted like an hour-glass near the base. Following annuli short and connate, the first being hardly visible except above. Terminal annulus as long as the two preceding, rounded at the tip, which bears a few very minute, curved hairs. The third joint from the tip of the first annulus, black. Face thickly covered with long, fine, black hair, with brownish reflections in certain lights; the conical prominences smoothly rounded, and separated by a deep furrow. Epistomum large, triangular, and tumid. Palpi and mouth parts brownish-red. Palpi apparently two-jointed, last joint long and decurved. Occiput with long, black hairs. Thorax with four narrow, dusky stripes, equidistant, becoming obsolete anteriorly. Scutel rather small, triangular, with rounded obtuse hind angle. Abdomen oval, depressed, segments one to four large, second largest; fifth and sixth narrow and small. Thorax, especially the scutel, and abdomen above clothed with long and very fine blackish gray hair. Coxæ large, the first pair brownish, the others gray, all covered with long, curling, black hair. Femora, tibiæ, and the four posterior metatarsi at base, brown. Fore tarsi, and tip of fore tibiæ, infuscated. Joints of the four posterior tarsi brownish with infuscated tips, last joints wholly black. Halteres with brown stem and black knob. Wings dusky, especially towards the tip. Veins brown, those bounding the distal ends of the basal cells faintly clouded, as is, to a much less degree, the posterior transverse vein. A long, brown, stigmatic cloud lies under the end of the first longitudinal vein.

One male, taken at Springfield, Mass., by Mr. George Dimmock.

Epibates Osten Sacken.

This genus was established [1] for a number of singular species of Bombylidæ, especially characterized, in the males at least, by the thorax being beset above with a number of sharp, rigid spine-like points. Baron Osten Sacken recognized seven species, and I am now able to add an eighth from the West.

Epibates Osten-Sackenii sp. nov. Plate 9, figs. 1, 1a.

Deep black; thorax in certain lights with a metallic dark blue lustre. First five segments of the abdomen margined behind with white pile. Costal border of the wings, including first basal cell, brown, small cross-vein continued upwards (apparently) by a black streak. Second basal cell hyaline. Eyes (♂) not quite contiguous. Long. corp., 14–16 mm. Long. al., 12–14 mm.

Closely resembles *E. magnus* O.S., but differs by the gray, instead of fulvous, hair on the occiput; larger size; the darker costal border of the wings, which includes in *E. Osten-Sackenii* the submarginal cell; the presence of a dark brown streak running across the submarginal cell, just above and appearing as a continuation of, the small cross-vein;[2] and finally in the white pile bordering the first five abdominal segments. In *E. magnus* the white border is confined to the first segment with a trace of white pile on the second.

From *E. marginatus*, which has a fringe of pile on all the abdominal segments except the last, it is distinguished by the third joint of the antennæ being distinctly longer than the first, instead of the reverse, and its much larger size, 14–16 mm., instead of 8 mm.

Three males in my collection, two taken in the summer of 1877 by Mr. Morrison in southern Colorado, and one taken July 14, 1877, by Mr. Scudder inthe Upper Leavenworth Valley, above Georgetown, Colorado, at an elevation of nearly 10,000 feet.

I have also two fine specimens of *E. muricatus* O.S., taken by Mr. Morrison in Colorado at a height of 9000 feet. The points on the dorsum of the thorax are distinctly arranged in four longitudinal

[1] Bull. U. S. Geol. and Geogr. Surv. Terr., III, No. 2, p. 268.

[2] This streak is not sufficiently shown in the figure on Plate 9.

rows, which is also evident, but less marked, in *E. Osten-Sackenii*. Between these four rows other, but smaller, points are scattered.

Plate 9, fig. 1, *Epibates Osten-Sackenii* Burg. 1, a, head.

Fig. 2, *Glutops singularis* Burg. Head in profile, and fig. 2, a, head in front. Fig. 2, b, antennæ; c, wing; d, tip of middle tarsus.

General Meeting. March 6, 1878.

The President, Mr. T. T. Bouvé, in the chair. Twenty-one persons present.

Messrs. Harold C. Ernst and John A. Estabrooks were elected Associate Members.

The following paper was presented by title: —

Upon the Occurrence of Zones of different Physical Features upon the Slopes of Mountains. By Prof. W. H. Niles.

During the summer of 1876, I observed among the Alps that many of the longer mountain slopes presented three different declivities, and that each of these divisions had its characteristic physical features. If from a moderate elevation and distance we observe the profile of an Alpine slope, which has these three divisions well marked, we first notice the greater steepness of the upper and lower portions as compared with the intermediate one. If we then study the features in detail we find that the summit region, excepting the snow-fields, presents a much broken or serrated outline, that the middle division exhibits a series of convex undulations like an irregularly corrugated surface, and that the lowest section may be either a single regular slope, or a series of slopes of different inclinations.

I have come to the conclusion that a similar distribution of physical features is a very common characteristic of mountain slopes, and it is with the hope of leading to a more thorough knowledge of our own hills and mountains, that I present these notes taken upon foreign ground.

The mountains which best exhibit the divisions in question are those which, like many of the Alps, rise directly from the level of the deeper valleys to a sufficient height to include an extensive range of meteorological conditions. Such mountains present, upon their slopes, zones of physical climate, which in altitudes are equivalent to the zones of latitudes. Accordingly the atmospheric agencies, which have their part in shaping the mountains, act with different degrees of intensity and with somewhat different results in each of these climatic regions. Upon the culminating portions of these mountains the atmospheric agencies usually predominate, to a greater or less degree, over the other physical forces. But the mechanical powers of the atmosphere diminish as we descend the slopes, and, in their action upon the rocks, usually become subordinate to other denuding agents. Thus the climatic regions of mountains become zones of different geological activities. Such a distribution of geological powers is attended by a corresponding distribution of geological results; therefore, upon such mountain slopes there may occur zones of different physical features.

Whether or not such physiographic zones are developed upon any mountain slope having a sufficient range of climate, depends in part upon the geological constitution of the mountain. The slopes which furnish the best examples, are those which have a comparatively uniform geological structure and composition. Different kinds and structures of rock, yielding with different degrees of readiness, acquire features which are more or less independent of altitudes, and which may confuse the characteristics of these zones or obliterate them. It is when similar geological structures are exposed to the predominating physical forces of different altitudes, that these mountain zones are best developed.

The eastern part of the southern slopes of the Bernese Alps presents this combination of geological and meteorological conditions. Having become somewhat familiar with this district, I shall consider the zones of these slopes as types of their kinds, although I am aware that many other regions might be selected with equal appropriateness. Here, as in many other districts, the zones of physical features nearly correspond in position and altitude with the more conspicuous regions with which the ordinary tourist has been made familiar. Most of the descriptions we have of the Alps, even those of the most popular character, mention three zones or regions of the mountains. The highest of these is the region of "Perpetual Snow-fields and Glaciers," or the "High Alps," below which is the "Alpine Zone," with its elevated pastures called "*Alps*" and its Alpine vegetation, while the "Sub-alpine Zone," or "Region of Coniferous Trees," occupies the lower slopes. Let us now notice the features of the corresponding physiographic zones.

ZONE OF WEATHERING.

This zone, among the Alps, corresponds most nearly with the "snow-region," although, since the marked recession of the snow-fields and glaciers, it extends in many places considerably below the limit of perpetual snow. It is in this region that the greatest vicissitudes of climate and the most sudden and violent changes of temperature occur. The alternation between heat and cold, which here takes place in clear weather between each day and night, gives the atmosphere great mechanical power over the rocks of the exposed ridges and steep slopes, from which the snow has been removed by winds and avalanches. The expansions and contractions of the rocks, which take place rapidly, tend not only to disintegrate the surfaces, but also to throw off irregular fragments. The almost daily melting and freezing of the water in seams and fissures is a powerful mechanical agent for breaking and loosening larger masses of rock. When the rocks are of that character which permits them to be more easily broken than disintegrated by these meteoric changes, as is the case with many crystalline rocks, then the unprotected slopes and ridges of this region acquire those rough and angular features which characterize mechanically broken rock. As the surface features of the uncovered rocks have been produced chiefly by those mechanical actions of the atmosphere usually called weathering, I speak of this region of the mountains as physiographically the Zone of Weathering. The principal ridges and great peaks of this zone are the ones most exposed, and they exhibit the wildest forms of rock to be found among the mountains. In the nearer views of this region, steep declivities with craggy outlines and angular contours predominate over the other forms of rock-surface. In distant views the profiles are steep, broken, irregular, or serrated, and stand out in bold contrast with the curved and gentler slopes below. A fine exhibition of this contrast is seen upon the northern face of the Chain of Mont Blanc, looking from the Brévent.

I do not include, in this description, the surface forms of the snow-fields of this zone, because they obscure the features which the mountains would otherwise present, and also protect them from the action of the atmosphere.

ZONE OF GLACIATION.

When this zone is well developed upon the slopes of the Alps, it extends from near the lower limit of the snow-region downward to the timber-line. The slopes are much more moderate than those above or below, excepting, of course, the steeper sides of the transverse valleys which cross this zone. While there occur here and there projections of rock, which have acquired or retained the rougher features produced by vicissitudes of climate, by far the larger proportion of rock-surfaces show the effects of glacial action in their convexly curved outlines and in the abundance of *roches moutonnées*. These smoothed surfaces yield much less readily to the atmospheric changes than the rougher surfaces of the region above. There are here, also, accumulations of glacial debris. It is in this zone that the moraines and glacial deposits most frequently retain their original forms, having usually been less changed by aqueous agencies than when they are found in the lower districts. These accumulations present a series of convex outlines, which, although less regular, still harmonize well in general form with the glaciated rock-surfaces. As it is here that the effects of ancient glacial action are best exhibited, and as the principal topographic features have been caused by such action, I call this region the Zone of Glaciation.

ZONE OF AQUEOUS AGENCIES.

If we start from the level of the larger Alpine valleys and ascend the range on either side, we usually find the first part of the acclivity steeper than the portion immediately above the timber-line. The slopes of this region are most frequently the sides or walls of the valleys. They are often quite steep and of comparatively uniform grade, and they are frequently clothed with sub-alpine forests, which extend, in but slightly undulating outlines, from the meadows of the valleys to the *Alps* of the zone above. The symmetrical and graded *cones of dejection* are frequently conspicuous in this region. In some other valleys, especially in the narrower and lateral ones, precipitous walls of rock predominate, while in many others precipices alternate irregularly with wooded or grassy slopes. Some of the rock-surfaces retain the rounded forms which they had upon the retirement of the ancient glaciers, but upon the sides of the valleys here noticed they are not sufficiently numerous or prominent to be considered the most characteristic features in the topography of the region. Furthermore, the weathering power of the atmosphere acts upon these slopes and cliffs to a certain degree, though not so powerfully as in the summit region. But more important is the abundance of streams which traverse this zone and furrow it with ravines, gorges, and valleys. These are often so near each other that the mere ridges between them have received all their characteristic features through their erosive action, and the whole zone is sometimes a more or less regular succession of such ravines and ridges.

Admitting the great difference of existing opinions as to the relative or predominating power which glaciers or streams of water have exercised in the excavation of these valleys, I believe careful study and comparison will satisfy the observer that the steepness of the slopes and the most characteristic contours and features of this zone have been produced by, or are inseparably associated with, some form of aqueous action. It is, therefore, on account of the predominance of this form of geological action in the presence of others, that I call this region the Zone of Aqueous Agencies. If we accept the above conclusion, it will follow that the topography of this zone is not essentially dependent upon climate. We accordingly find this zone represented, even among the Alps, considerably below the climatic zone of sub-alpine vegetation.

Considering now these three zones in their climatic relations, we recognize that in the features of the zone of weathering we have a topographical expression of the geological agency of the existing climate. In the features of the zone of glaciation we have a preserved record of the action of a power which originated in the peculiarities of a past climate, while the features of the zone of aqueous agencies are not of climatic origin. We may, therefore, speak of these zones as climatic, past-climatic, and non-climatic in their origin.

It will be understood that the above descriptions apply only to those mountain slopes upon which each of these zones are well characterized. But there are Alps which have the sub-alpine, the alpine, and the snow-regions distinctly marked, and yet one or two of the physiographic zones here described are wanting. This usually arises from peculiarities of geological constitution. When, for example, the rocks at the base are softer, or yield more readily than those of the upper portions, the denuding agents may drive back the face of the lowest slope till it joins the uppermost zone directly by obliterating the intermediate one, and one steep, precipitous slope from the base to the summit of the mountain may be the result. Among other mountains the lowest zone may be wanting, and the zone of glaciation may extend to the base. A great variety of mountain forms may result from such modifications of these three elements of the typical mountain slope. I believe that the mountains which have these zones well characterized, should be regarded as presenting the types of those orographic features which arise from the predominance of certain physical agencies at certain altitudes.

Furthermore, I believe that careful studies of these typical features may lead us to a better analysis of the features of our own mountains. Although we have no mountains in the Appalachian system which reach the snow-line, yet the summits of many are of sufficient elevation to acquire, in our rigorous climate, at least a mild expression of the features produced by weathering at greater altitudes. In some instances the rock has been broken till now the summits are almost or entirely composed of the fragments, while upon other summits the mechanically sculptured, but not completely dissevered, rock still remains. Upon most of our hills in this and in higher latitudes, the region of glaciation is the most extensive and best characterized one, although its vegetation is rarely of alpine character. There is no discrepancy in this, for the topographic features of this region were mostly formed under the forces of a past climate, while the alpine vegetation survives at its present altitude upon the mountains, under the conditions of the present climate. Hence many of our hills, from their summits to their bases, are characterized by the topographic features of the zone of glaciation, and yet sub-alpine and deciduous forests are found upon their slopes.

I have spoken of these topographic features as distributed in zones, because I have considered them only in their relations to the slopes of mountains. I do not claim that all of the features of an entire country, from its greatest elevations to the level of the sea, may be classified in three zones. Descending such an extensive range of surface, we find a repetition of these features; a region of aqueous agencies is frequently succeeded by one of glaciation at a lower level, and this may be followed by another of aqueous agencies. But the individual slopes of any district may exhibit a part of the same law which we recognize more distinctly upon the slopes of mountains. The aqueous agencies act with greatest power upon the lower portions of such slopes, and this is as true of the sea as of streams. But the recession of the cliff-like slopes of sea-coasts and valleys is not entirely from the aqueous denudations at their bases. The mechanical action of the atmosphere through frost materially assists in the work in our climate, but its action is most marked upon the upper portions of the slopes, while the waves and currents work in their zone below. I might easily multiply the applications of this principle, but it is my object to present the general law in accordance with which the topographical features of mountains may be classified, and not to follow it into minute details.

Mr. S. H. Scudder exhibited drawings of a fossil butterfly from Florissant, Colorado, the first fossil specimen of this group of insects yet found in America. He has given the name Prodryas to the form.[1]

Dr. T. M. Brewer called the attention of the meeting to a bird new to our fauna, viz., the Louisiana Tanager, a specimen of which was taken in Lynn, during the severe snow storm of February, where it was undoubtedly carried by the gale from its home.

General Meeting. March 20, 1878.

Vice-President Mr. S. H. Scudder in the chair. Forty-one persons present.

Mr. Scudder announced the death, on March 17th, of Dr. Charles Pickering, a member of the Society since 1858, and so well known from his connection with the Wilkes Exploring Expedition and his works upon the Races of Men and the Geographical Distribution of Plants.

It was voted to request Mr. F. W. Putnam to prepare a notice of Dr. Pickering's life for the Proceedings.

The following paper was read: —

Upon the Relative Agency of Glaciers and Sub-Glacial Streams in the Erosion of Valleys. By Prof. W. H. Niles.

In some remarks[2] which I made at a meeting of this Society in April, 1873, I stated that my observations among the glaciers of the

[1] U. S. Geol. and Geogr. Surv. Terr. Bull. IV, ii.

[2] Proceedings of the Boston Society of Natural History. Vol. XV, pp. 378-381.

Alps during the previous summer had led me to the conclusion "that glaciers were not the principal agents in the excavation of valleys." I have since had the opportunity of spending two summers more among those glaciers, and the observations which I made have not only confirmed my previous conclusion, but they have also furnished me additional evidences of the excavating power of sub-glacial streams. This time I was more successful in getting underneath the ice than before, particularly upon the right side of the Great Aletsch Glacier where it passes the cliff near the Bell Alp Hotel. The way glaciers usually move over the ordinary *roches moutonnées*, bridging the hollows between them without conforming to all the inequalities of surface, has been made so well known that additional description is unnecessary here. Under these conditions the glacier does not act upon the lowest surfaces of rock beneath it, and these show by their roughness and irregularity that they were not shaped by its action. It, therefore, becomes evident that in such places some power must have acted or is now at work lower than the surfaces upon which the glacier moves.

Under the edge of the Great Aletsch Glacier I observed in a few places, that pieces were being broken from the lee edges of the *roches moutonnées* by the pressure concentrated upon certain stones or boulders which had reached these edges in their progress under the ice, but I was not successful in my search for like phenomena in connection with other glaciers. But this action, even if we could suppose it to be sufficiently common, would serve to break away only the same prominent portions of the rock which the glacier abrades.

The ice of the glacier, however, is sufficiently plastic to conform to certain kinds of irregularities of surface, and of one of these there are good examples at the above-mentioned locality. There are long, narrow ridges, the trends of which are the same as the strike of the rock and nearly parallel with the direction of the motion of the glacier. A longitudinal section of one of these ridges gave an outline like that of an elongated *roche moutonné*, while a transverse section showed quite a regularly corrugated surface. These corrugations originated in the bedded structure of the rock, the upturned edges having been rounded and smoothed by the action of the glacier. The ice had time enough to conform to these longitudinal furrows and ridges as it flowed over them lengthwise; and in August, 1876, as it passed the lee end of a ridge, it preserved the mould of the profile so perfectly that for more than twenty feet the blue arch presented a series of parallel furrows, like the flutings of a Doric column.[1] I also observed many other examples of the same kind, though none so regularly and beautifully perfect.

There was there at that time another highly interesting and instructive exhibition of glacial action. Within a few feet of the down-stream end of one of these elongated *roches moutonnées* and upon its crest, there was a boulder fully three feet in diameter, which evidently had been slowly moving along this ridge for some distance, probably from its upper end. There were two sides of this block of stone which were not incased in ice, viz., the lower one resting upon the rock, and the one facing down the glacier. From the lower end of the ridge of rock I looked at the boulder through a tunnel of pure, blue ice, which was continued as a deep furrow in the under surface of the glacier for fully thirty feet from its beginning. As this was produced by the ice moving over and beyond the boulder, it was evident that the ice was moving more rapidly than the stone. I afterwards found other examples of the same kind, but none so favorably situated for a striking exhibition of this property of ice. It will be understood that these stones were sufficiently below the upper surface of the glacier to be removed from the effects of the ordinary changes in the temperature of the atmosphere. Although stones which are exposed to such changes may be frozen into the ice at the edges of the glaciers, yet I believe these were so situated as to correctly represent the conditions and movements of those at still greater depths. If this is correct, and I believe it is, it follows that such fragments of rock are not rigidly held in fixed positions in the under surfaces of glaciers and carried irresistibly along at the same rate, but that the constantly melting ice actually flows over them, and that their motion is one of extreme slowness, even when compared with the motion of the glacier itself.[2]

[1] I see by quotations from the "Nouvelles Excursions et Séjours dans les Glaciers et les hautes règions des Alpes," by Prof. E. Desor, that he there described similar features which he observed in connection with the Aar Glacier in 1844, but I have not been able to obtain a copy of the work for examination.

[2] In an article in The Geological Magazine, Decade II, Vol. III, 1876, published during the same season that I was making these observations, and which I had not then seen, being away from home, Rev. T. G. Bonney clearly states the same conclusion, presenting as evidences the appearances of certain boulders observed by him in 1875, near the terminations of the Glacier des Bois and the Glacier d'Argentière. I do not learn from what he has written, however, that he saw the ice flowing over stones in the manner I have here described. It is, therefore, my pleasure to have witnessed what I consider to be a proof of the accuracy of the conclusion which Prof. Bonney ably drew from other sources.

If this is granted, it must then be admitted that the abrading power of glaciers is much less than if the fragments of rock were usually firmly set in the ice. This is one of the many reasons which I have for believing that the erosive power of glaciers is not sufficient, in itself alone, to account for the excavation of those valleys in which they are found.

Among the phenomena which attract the attention and obstruct the progress of the explorer under a glacier, is the abundance of streams. A short distance below the edge of the glacier the ice is constantly melting, and in every place accessible to the observer the water falls, usually in large drops but sometimes in streamlets. Thus the surfaces not covered by the ice are exposed to a constant fall of water, which, first forming numerous rivulets, soon collects in small and rapid streams. The dropping of the water and the rushing of the torrents, the frequent slipping of smaller fragments of stone which have been started by the rivulets and the occasional tumbling or plunging of a larger mass, the incidental cracking of the glacier and the frequent crash of pieces of falling ice, all unite in impressing upon the listener that this is a busy place. Where the glaciers rest upon the upper portions of the *roches moutonnées*, the streams are formed in the hollows between them which the ice does not fill; therefore, under such conditions their erosive power is exercised upon those lower portions of the rock-surface which are not effected by the movements of the glacier.

In estimating the erosive power of a stream we must take into consideration, not only its volume and velocity, but also the more important factor of the materials with which it is charged. The importance of this is well illustrated by the modern appliance called the sand-blast, in which it is not the violence of the current of air or steam but the sand which it carries with it, which cuts away the surfaces of stones, metals and glass with such astonishing rapidity. Sometimes this element has been overlooked, as, for example, when it has been argued that because pure water may rush violently over a rock for a long period without producing any perceptible change, therefore, the valleys which now are or formerly were occupied by glaciers must have been excavated by the ice rather than by the streams below it. A sub-glacial stream, considered as an agent of erosion, should never be compared with a stream of pure water. All of the streams beneath a glacier are charged with small, angular fragments of stone, such as glaciers transport in immense quantities. Any one who has walked over the middle and lower portions of a glacier in summer has not failed to notice the small fragments of stone which often darken and sometimes cover the surface. When these are examined they are found to be sharply angular; and if the examination is extended to the medial and lateral moraines, they will be found to contain immense quantities of similar materials. These small fragments, as well as large ones, find their way into the sub-glacial streams, in which by the sharpness of their angles they become most effective instruments in the work of erosion. The materials transported by ordinary streams, even when swollen by heavy rains, are of a different nature. The small stones and gravels which they receive are usually more or less rounded, while the finer materials are chiefly loam, clay, soil, or well-worn sand. The erosive power of a current carrying such old, worn, and often soft materials, is much less than that of one charged with the new and sharp instruments of the sub-glacial streams; hence the denuding agency of the latter should not be estimated by observations upon the former.

The excavating power of these streams is shown in the number of pot-holes which they produce. The steepness and irregularity of their courses, the abundance of water with stones and sand, and in many places the presence of ice causing gyratory movements of the water, make these streams peculiarly efficient in this work. Sometimes these pot-holes succeed each other so closely in the course of the stream, that as they increase in size they unite and form a deep, narrow gorge, whose walls present a succession of their concave surfaces.

Furthermore, the ice of the glaciers often exercises a controlling influence upon the positions and courses of these streams. It is not uncommon to find a stream flowing along the edge of the glacier considerably below its surface, in a channel one side of which is ice and the other side rock. In such instances the streams are often supported by the ice at a considerable elevation above the bottom of the valley where they would otherwise be. The power which a glacier may have for preventing water from flowing directly into the lower portion of its valley, is well illustrated by the Märjelen See, a lake which owes its existence to the ice-wall of the side of the Great Aletsch Glacier which forms one end of the basin which it occupies.

The lateral streams above described are abundantly supplied with small and large pieces of stone from the lateral moraines, and they thus become agents in the erosion of the sides of the valleys. It will probably be remarked that such streams must naturally erode the ice more rapidly than the rock, but it must be remembered that the ice is constantly renewed by the motion of the glacier. It will be readily seen that such streams, by the peculiarities of their situation and action must exercise an influence in determining the precipitous character which the sides of glacial valleys so often have. If it is objected that such water-worn surfaces are rarely met with upon the sides of valleys from which the glaciers have retreated, it must be remembered that the ice above the streams and the atmospheric agencies modify these surfaces after they have been left by the streams, hence the rocks have the features which they received from the last agent which acted upon them.

Still lower and quite underneath the side of the glacier there are larger and often much longer lateral streams, which are much more important agents in the excavation and formation of the valleys. These, flowing in channels of their own formation in the rock and quite below the ice, tend to deepen the valley along its edges and to give it that cañon-like form so often seen.

Sometimes the aqueous erosion under the sides of a glacier is greater than it is under the medial portion, and when this has been continued for long periods the edges of the valley have become the deepest portions, and when the lower end of the glacier has receded to this part of the valley it is often bifurcated, its terminations being upon opposite sides of the rocky eminence left in the central part of the valley. Such knolls or hills occur in the valleys of ancient glaciers, as, for example, in the valley of the Rhone at Sion, and they have always been a puzzle to the advocates of a purely glacial origin of such valleys. If, however, we duly recognize the power of sub-glacial streams, the hills which are sometimes left in positions where they have been fully exposed to the action of glaciers appear as a normal and not as an anomalous result of the agencies which have excavated such valleys.

With many other glaciers and often with other parts of the same glacier, the medial stream is the most important one in volume and power, and then it tends to make that part of the valley the deepest, and the glacier assumes a corresponding form.

In conclusion I will state that the observations of three summers among the glaciers of the Alps have led me to estimate the relative agency of glaciers and sub-glacial streams in the erosion of valleys as follows: viz., that the sub-glacial streams are of primary importance in working in advance of the ice in deepening and enlarging these valleys, and that the glaciers abrade, modify, and in a measure reduce the prominent portions left by the streams, and give them the well-known glaciated surfaces.

[I have not space in the narrow limits of this article to consider the valuable and exceedingly numerous contributions of others to the subject of glacial action.]

Dr. David Hunt explained a theory to account for the decrease of prognathism in civilized man.

Section of Entomology. March 27, 1878.

Mr. H. L. Moody in the chair. Fourteen persons present.

Mr. S. H. Scudder exhibited a number of western Acridians in illustration of one type of dimorphism.

The different forms had in many instances been described as distinct species, and, indeed, been referred to distinct genera ; the short winged forms having usually been placed in Pezotettix, while the long winged types had been described as Callipteni. This peculiarity is found in ten or twelve species, mostly occurring in the Mississippi valley ; usually there is a very decided difference in the length of the wings, although in the long-winged forms the tegmina seldom surpass or even reach the tip of the hind femora; and no intermediate forms occur. In one instance three varieties occur, which are with little doubt to be referred to one species; and in this case the variety with the longest wings has tegmina which extend past the hind femora. The dimorphic forms of any one species are found at the same stations, and can not be considered racial. Similar dimorphism has long been known in Orthoptera, and this should doubtless serve as a sufficient reason to group together several of the forms of Xiphidium which had been described as distinct species, and the two northern forms of Gryllotalpa, as well as some so-called species of Gryllus and Nemobius.

General Meeting. April 3, 1878.

Vice-President Mr. S. H. Scudder in the chair. Forty-one persons present.

Mr. Scudder announced the recent sudden death of Prof. C. F. Hartt, Director of the Geological Survey of Brazil, and a Corresponding Member of the Society.

Prof. B. G. Wilder, of Cornell University, exhibited to the Society living examples of the western mud-fish, *Amia calva.*

He showed how the breath exhaled from the very cellular and vascular air-bladder was collected by forcing the fish to ascend into a funnel connected with a glass tube supported by a frame. The air so collected contained from 1 to 3.4 per cent of carbonic acid, according to the time it was retained by the fish. By means of diagrams, preparations, and injected specimens, Prof. Wilder also explained the structure of the air-bladder, and the way in which it may receive as much blood as the other viscera and the trunk. Each of the two pulmonary arteries is formed by the union of the fourth opibranchial artery with a branch of the third; and each pulmonary artery is as large as either the aorta or the cæliac artery.

The fish seems to employ the aerial mode of respiration chiefly when the water is stale, or muddy, or otherwise imperfectly fitted for the ordinary branchial respiration.

Further details as to the structure and habits of Amia, with references to authors, are to be found in the Proc. Amer. Association for Advancement of Science for 1877.

Prof. Wilder showed an apparatus for illustrating the action of the diaphragm in respiration. It consists of a tubular bell-jar with a piece of elastic rubber tied across the base. The lungs of a cat are suspended within the jar from a glass tube passed through a rubber stopper. For use the stopper is loosened and the jar is pushed down upon a convex surface (like the bottom of a flask) so as to cause the rubber diaphragm to bulge upward into the jar. The stopper is then made to fit lightly, and when the jar is lifted the descent of the rubber causes the lungs to expand, the air entering through the tube.

General Meeting. April 17, 1878.

The President, Mr. T. T. Bouvé, in the chair. Forty-two persons present.

The following paper was presented: —

Sketch of the Life and Scientific Work of Professor Charles Frederic Hartt, by Richard Rathbun, late Assistant Geologist to the Geological Commission of Brazil.

In the death of Professor Charles Frederic Hartt, chief of the Geological Commission of the Empire of Brazil, we recognize one of the saddest losses science has recently suffered.

Prof. Hartt was just in the prime of life, full of vigor, with a mind already richly stored with the results of more than twenty years of almost constant exploration and investigation. Had he been advanced in years, with his labors nearly completed, although he might have become more endeared to us through longer association and friendship, yet we could then have consoled ourselves with the thought that he had finished the work he had laid out for himself. But such was not the case; he left the great work of his life merely begun. His time was wholly given to the solution of some of the most intricate problems in the fields of science and the arts, but only here and there, in his short publications, do we catch glimpses of the inexhaustible store of facts he had accumulated and theories he had devised.

He was at one time an active member of this Society, and a student at the Museum of Comparative Zoology in Cambridge, and nowhere did he have a larger circle of sympathetic friends, than among his scientific associates at these two institutions, some of whom were students with him under Prof. Agassiz. To these, and to his co-workers everywhere, it would be needless for me to eulogize his character. He was hard-working, unselfish, and affectionate, never over-bearing to his inferiors, but ever showing the same respect for those laboring under him as for his equals. His deep sense of right caused him to weigh the claims of others generally more fairly than his own, and to his own loss. He was gifted to a wonderful degree with an original and inventive mind; while his early training laid a firm foundation for a life of great usefulness. Thus richly endowed he had started upon a most enviable career, and gave promise of attaining the highest eminence. His tastes were varied, leading him into natural science, language, art, and music, in all of which he accomplished original work of the highest grade. He loved study, and always entered with his whole soul into the investigation of whatever subject interested him. He was filled with a noble ambition and actuated by the purest purposes, and thus ever sought to advance the interests of science without thought of personal gain. In his short life he accomplished much, but so great was his confidence in the future, that he withheld the publication of many of his discoveries until they should be further developed and perfected, little expecting so sudden a termination of his work.

Although linguistic studies, as well as art and music, were to him favorite subjects of investigation, they were generally treated from a scientific stand-point, and were made subordinate to the more special field of inquiry, geology, to which he early became enthusiastically devoted. With an ever increasing love for scientific research, which finally came to absorb his whole attention, he died a martyr to science. Eminently successful as a teacher, his students shared his deep enthusiasm, and his influence upon science will long be felt through the labors of those who enjoyed the advantages of his careful training.

Prof. Hartt was the oldest son of the late Jarvis William and Prudence (Brown) Hartt, and was born at Fredericton, New Brunswick, August 23, 1840; he died at Rio de Janeiro, March 18, 1878. His last illness was of scarcely more than forty-eight hours duration; his death was sudden, and, until near the end, entirely unlooked for by even those who were watching over him. He was attacked with a light fever on a Friday night, and this continued without dangerous symptoms until nearly midnight Sunday, when he became delirious. In this state he remained until three in the morning, when he passed away. The unexpectedly fatal termination of his illness can be accounted for, only on the supposition that his system had become greatly enfeebled by his constant, hard work and anxiety during the long, tropical summer. He had been accustomed to leave Rio in the hot season, but this year circumstances prevented his doing so.

Hartt's early education was carried on under the direct supervision of his father, who, for a long time, was prominently identified with the educational interests of Nova Scotia and New Brunswick. He studied at Horton Academy in Wolfville, N. S., and afterwards at Acadia College, where his father was at the time a professor. In 1860 he graduated from the College with high honors, receiving the degree of Bachelor of Arts, and later that of Master of Arts. In 1869 he was married to Miss Lucy Lynde of Buffalo, N. Y., by whom he had two children, a son and a daughter. They all survive him.

At the age of ten, Hartt began to show a decided taste for natural history studies, in which he was aided and encouraged by his teacher, Prof. Cheeseman. His talent for drawing and for the acquisition of language showed itself at an equally early period, and we are told that he became an instructor of drawing at Acadia College when a mere boy. His liking for natural history was, however, the stronger, and he entered with great zeal into the work of geological investigation. Before he left college he had already explored a large portion of Nova Scotia, which province he traversed from one end to the other on foot. In all his expeditions he made large collections of specimens, whenever there was opportunity. His studies always took the character of independent, original investigations, and their great value has served to identify him prominently with the history of Acadian geology.

In 1860 he removed with his father to St. John, N. B., for the purpose of organizing with him a college high school; but much of young Hartt's time was at once devoted to the exploration of the rocks in the vicinity of St. John. It was these researches that first made him widely known to the scientific world. His discovery of the remains of fossil insects in the Devonian shales of St. John attracted the attention of Prof. Agassiz, and helped to decide the future course of the young provincial geologist. Accepting an invitation from Prof. Agassiz to become a student at the Museum of Comparative Zoology, he went, in 1861, to Cambridge, where he spent the greater part of the next four years. Here he diligently improved the great opportunities afforded for study and original research, and made rapid progress. The great temptation to devote himself to the investigation of the immense stores of undescribed material contained in the Museum, did not entirely withdraw his attention from the study of the geology of his native land, his vacations being mostly spent in continuing the explorations already begun in the Provinces.

Before he went to St. John in 1860, the geology of southern New Brunswick was very imperfectly known, and it was about this time that careful researches were begun. Hartt carried on his work, partly alone, and partly in connection with the Survey of southern New

Brunswick, under Prof. L. W. Bailey. He did not, however, confine himself to New Brunswick, but gave much time to the study of the geology of Nova Scotia. His name figures prominently in the report of Prof. Bailey, published in 1865, and also in Dr. Dawson's "Acadian Geology," (2d ed., 1868). Many of his results were published in the reports of others, and it is thus difficult to tell how much we should accredit to Hartt; but some of his results have been given us separately, so that we are able to make the following general summary of his principal discoveries in the Provinces.

In 1861 he discovered that the Devonian shales at Duck Cove, Lancaster, near St. John, were richly fossiliferous, and contained, in addition to the many remains of land plants, fossil insects, the oldest of any known to science. Mr. Geo. F. Matthew, of St. John, had previously found a few obscure plant fragments in these same beds, and also in the shales at the foot of the city of St. John. These were described by Dr. Dawson, who also worked up most of the species afterwards obtained by Hartt. Mr. Hartt's observations on these beds were continued through the years 1861, '62, and '63, and he has given us, as a result of his labors, a minute description of the several beds and their fossil contents. Of insects there were discovered five species, represented by fragments of wings only. Mr. S. H. Scudder, who studied them, has referred them all to the Neuroptera, in part to new, in part doubtfully to old, families, and suggests that some of the forms represent synthetic types.

Mr. Hartt, in connection with Prof. Bailey and Mr. Matthew, made in 1864, the first large collection of fossils obtained from the Acadian or Primordial group in the vicinity of St. John. The principal localities examined were Ratcliffe's ravine and Coldbrook, at which latter place Mr. Matthew had previously discovered a few obscure forms. From these, however, no satisfactory conclusions as to the exact age of the beds had been attained. The new collections, consisting mainly of finely preserved trilobites, were placed in Hartt's hands for study, and by him worked up with great care at Cambridge, Mass. He published, in 1865, his preliminary report upon them, in which he proved that the beds in which they were found are equivalent to about the "étage C" of Barrande, or the Potsdam group proper of America. This report contained the first positive evidence of the existence of Primordial strata in New Brunswick. Descriptions of the principal fossils by Hartt, with many figures, are contained in Dr. Dawson's "Acadian Geology" (1868).

It was also in 1864 that Hartt obtained proof of the Pre-Carboniferous age of the gold of Nova Scotia. His observations were made at a place called Corbitt's Mills, where the well known auriferous Silurian slates are immediately overlaid, unconformably, by conglomerates, grits and sandstones of Lower Carboniferous age. The lower portion of the conglomerates and grits also contain an abundance of gold, which was undoubtedly extracted from the underlying slates, while the former deposits were in process of formation, and was mixed with the loose gravel material which afterwards became consolidated.

We owe to Hartt the careful investigation of the relations of the different members of the Carboniferous limestone deposits in the neighborhood of Windsor, Stewiacke, etc., Nova Scotia. He collected and studied the faunæ of each separate set of beds with much pains, and in this way was enabled to determine their sequence. The fossils, which are marine, are very numerous, and some new species were described by him in the "Acadian Geology." Much interest attaches to the study of this formation at the above localities, where, in the upper beds, occur many forms common to both the Carboniferous and the Permian, and a great likeness is apparent to the upper members of the Carboniferous system in the western United States, called Permo-Carboniferous. Dr. Meek, who examined the fossils, suggested that we might have here "what Barrande would call an upper Coal-measure, or even Permo-Carboniferous fauna, 'colonized' far back in the Sub-Carboniferous period." Dr. Dawson has greatly enlarged on Hartt's results, and shows that the divisions made by him are of a more general character than he had supposed.

In many places in his "Acadian Geology," Dr. Dawson refers to the work of Prof. Hartt in various parts of Nova Scotia and New Brunswick, and it is known that, at the time of his death, he had still remaining some original material from the Provinces which he never had the time to study or publish.

Upon the organization of the Thayer Expedition to Brazil, by Prof. Agassiz, Mr. Hartt was appointed one of its two geologists, Mr. Orestes H. St. John being the other. This expedition left New York in April, 1865, and returned in July, 1866, having been absent a little more than a year. This was the strong and final inducement that called Hartt away from the geology of his own country. Although he was not fortunate in finding a very rich geological territory during his wanderings, while connected with the Thayer Expedition, he saw enough to thoroughly interest him in returning again to Brazil, and in finally giving his whole attention to Brazilian studies. There is little necessity for going minutely over the details of his first few trips to that country. Accounts of them have been published, and are easily accessible.

The primary object of the Thayer Expedition was the investigation of the distribution of the fresh-water fishes of Brazil, but much time was also devoted to the study of its geology. No new fossiliferous deposits or localities were discovered, and of those already known, only the Cretaceous at Bahia, and the Post-Pliocene of Lagoa Santa, were explored. Prof. Agassiz limited himself mostly, in his geological work, to the examination of the superficial deposits at Rio de Janeiro and on the Amazonas, which were studied in connection with the question of glaciers. Hartt was retained near Rio for some time, in making examinations of the many cuttings around that city. After this work was completed, his field of exploration lay mostly between Rio and Bahia, where, with Mr. E. Copeland of Boston as a companion, he carefully studied the geological and other features of the coast and of the principal river basins leading to it. Large collections of the fresh water fishes of the rivers and of the marine animals of the coast and reefs were made. The region from Rio to Bahia is entirely metamorphic, consisting mostly of gneisses, covered in large part with loose or only partially consolidated materials, without fossils. In consequence of this absence of fossils, no results in systematic geology were obtained, but, nevertheless, Hartt's studies of the geology of this monotonous tract were of great interest. At the Colonia Leopoldina, in southern Bahia, he had the opportunity of observing the customs, etc., of the now nearly extinct Botocudo Indians.

In the neighborhood of Porto Seguro he explored the coral and sandstone reefs, which latter are such a prominent feature on the Brazilian coast. He was the first to carefully work out the structure and mode of formation of these sandstone reefs, although Darwin's short description of them is not far from correct.

After Hartt had returned to the United States from the Thayer Expedition, he felt that he had left unfinished some of the more important of the investigations he had made in Brazil. He was unable to report as fully as he wished on many subjects of interest which he had in part studied. So in 1867 he returned to Bahia, to better perfect his old work and continue his observations. He worked out the geology on the line of the Bahia railroad in detail, and collected some fossils from the Cretaceous formations which compose much of that region. He also studied the structure of the Abrolhos Islands and Reefs, which lie off the coast of Bahia, to the southeast of the town of Caravellas. The islands are of stratified deposits, capped with trap, while the reefs, which had never before been to any extent examined by a naturalist, are of coral, generally assuming curious tower-like forms, and often growing together to form a large connected expanse.

In addition to throwing new light on the formation of certain kinds of coral reefs, he also discovered a large number of species of corals, of which the majority were new, but belonged to West India types. The absence of many prominent West India genera, such as *Madrepora*, *Meandrina*, *Diploria*, etc., was noted by him. The Cretaceous region of Sergipe was visited, and yielded many fossils, which have been in part described by Prof. A. Hyatt.

In the short interval which elapsed between his first and second trips, he was engaged in scientific teaching and lecturing in and near New York city, at the Cooper Institute, Pelham Priory, and other places, where he attained much success and made many warm friends who aided him in his second Brazilian expedition. In 1868, soon after returning the second time, he was appointed Professor of Natural History in Vassar College; but he resigned this position in the autumn of the same year to accept the chair of Geology in Cornell University, where he was retained at the head of the department of geology until the time of his death. In 1869 he was elected General Secretary of the American Association for the Advancement of Science, to serve at the meeting of 1870, but before that time he had departed on his third trip to Brazil.

While at Cornell University, when not occupied by college duties, he was engaged in working up the results of his Brazilian explorations, and in preparing his report, as geologist to the Thayer Expedition. This report, however, grew to so large a size, and was so complete in itself, that it was found advisable to publish it separately, in 1870, as "The Geology and Physical Geography of Brazil." It forms a large octavo volume of over six hundred pages and contains, in addition to an account of his own researches, a résumé of our previous knowledge of the natural history of the country. It is thus not limited to a discussion of the subjects indicated by the title, but treats of the topographical and general features of the country, of its flora and fauna, both marine and terrestrial, and its mining, agricultural, commercial, and manufacturing interests. The numerous maps and sketches, with which it is illustrated, were drawn by Prof. Hartt himself. The greater part of them represent regions never before depicted. The subjects discussed, mostly from personal observations, are the following : The provinces of Rio de Janeiro and Espirito Santo ; the Mucury and Jequitinhonha basins in Minas Geræs ; the Abrolhos Islands and Reefs ; the Southern coast of Bahia, and the vicinity of the city of Bahia and the Bahia Railroad ; the provinces of Sergipe and Alagoas ; the basin of the Rio São Francisco below the Falls ; and the vicinity of Pernambuco. His description of the interior of the province of Bahia, and the upper São Francisco basin, are made up largely from the notes of Messrs. St. John, Allen, and Ward of the Thayer Expedition. The volume closes with a valuable appendix on the Botocudo Indians.

From a review of his book, we find that the following geological formations were known, or supposed, to be present in Brazil at the time of its publication : —

Eozoic. The gneisses, etc., of the plateau of Brazil, including the Serra do Mar, and the plateaus of Guyana and the Chiquitos region were, at least for the most part, referred to this age.

Silurian. It was suggested by Hartt that the clay and talcose schists, itacolumites, etc., of the gold regions of Minas Geræs are probably referable to the Silurian. They closely resemble similar formations in Nova Scotia. No Silurian fossils were found.

Devonian. Unknown.

Carboniferous, including the beds of coal, with accompanying deposits, containing remains of plants, in Rio Grande do Sul. Prof. Agassiz, in "A Journey in Brazil," has referred to the finding of Palæozoic fossils by Major Coutinho on the Lower Tapajos, but it remained for Hartt to afterwards determine their Carboniferous age.

Triassic (?). A thick series of red sandstones, underlying the Cretaceous over a large part of Sergipe. No fossils were found.

Cretaceous. Existing through most of the northern coast provinces, and forming separated basins, partly of marine, partly of fresh-water, origin. Fossils had been collected at a few localities. The Cretaceous had also been found on the Rio Purus.

Tertiary. The clays and ferruginous sandstones of the coast, and of many of the river basins and plateaus, were referred to the Tertiary, although there were no palæontological evidences as to their age.

Drift. Prof. Agassiz's ideas of the distribution of drift were mostly accepted, and Hartt adds his own personal observations made in the vicinity of Rio, Bahia, etc.

The above general account suffices to show how little was known of the systematic geology of Brazil, at the time when Hartt had finished his second trip to that country.

In the year 1870, the same in which his book was issued, Prof. Hartt organized the largest of his own expeditions from the United States. It was composed, besides himself, of Prof. Prentice and eleven students of Cornell University. His object in taking so many young men into a new field was to give them thorough practical training, and to stimulate them to undertake original work. He says, in his report of this expedition, that he did not expect to make scientists of them all, but hoped that some might be thus induced to accept that calling. Of that band of students, he refers to four (O. A. Derby, T. B. Comstock, H. H. Smith, and W. S. Barnard), who are to-day doing scientific work of a high character. The means for defraying the expenses of the trip were contributed by several parties, most prominent of whom was Mr. E. B. Morgan of Aurora, N. Y., whose name has been given to this and the subsequent expedition.

Not having been successful in his former trips along the coast, in finding other fossiliferous deposits than the Cretaceous, Prof. Hartt determined to change his field of research, and explore the Amazonas. Accordingly, he went with his party directly to Pará, and in the neighborhood of this city spent some time in training his inexperienced assistants. The tributary rivers, Tocantins, Xingú, and Tapajos, were then examined throughout their lower courses, and many valuable geological facts ascertained. On the Tapajos were discovered the highly fossiliferous Carboniferous deposits from which, as already mentioned, Major Coutinho had before obtained some undetermined fossils.

At the falls on each of the above named rivers were found series of metamorphic rocks, which have been referred, from their position and lithological characters, to the Silurian. Passing to the north of the Amazonas, they minutely investigated the geology of the vicinity of Monte Alegre and the Serra of Ereré. On the plain of Ereré were discovered sandstones and shales with characteristic Devonian fossils, corresponding more or less with those of the Hamilton and Corniferous groups of New York State. These were the first Devonian fossils found east of the Andes in South America.

One of the party examined the ancient Indian mounds of the island of Marajó, at the mouth of the Amazonas, at that time only imperfectly known, and discovered large quantities of richly ornamented pottery, mostly fragmentary. These have since been made the subject of considerable study by Professor Hartt. The sea coast was examined at several points, from Pará to Pernambuco, and, in the neighborhood of the latter city, the fossiliferous Cretaceous formations of the province of the same name, were studied for the first time. At all of the localities visited they made large collections in geology and zoology, which were sent to the United States and are now contained in the museum of Cornell University.

Prof. Hartt's researches on the Amazonas did not tend to bring proof of the former existence of glaciers there. The Serra of Ereré was found not to belong to the series of table-topped hills, as Prof. Agassiz had been led to suppose, but to consist of inclined strata of very irregular outline. The Devonian fossils of the plain were from a portion of the supposed "drift" material of Agassiz. Prof. Hartt did not find time to examine any of the true table-topped hills on this trip, and it was largely for the purpose of doing this that he returned to the Amazonas in 1870, accompanied only by Mr. O. A. Derby.

The table-topped Serra of Parauáquara and the Serra of Tauajurí, of another class, and both wholly unknown to science, were visited, but gave no evidence of having been formed through the agency of glaciers. The fossiliferous localities of Ereré and the Tapajos were re-examined, and larger collections made from them. The fresh-water shell heaps of Taperinha were carefully explored by Prof. Hartt, and the mounds of Marajó by Mr. Derby.

At no time on either of these two trips did Prof. Hartt lose a moment in idleness; when no other work could be done, he busied himself in studying the Mundurucú and Maué dialects of the modern Tupí language of the Amazonas, and in bringing together the stories and myths which are current in the tribes. He has prepared a large volume on the grammar, vocabulary, and stories of this language, which yet remains unpublished.

Prof. Hartt returned to Ithaca, N. Y., about January, 1872, where he remained two years and a half, giving all the time he could spare from his college duties to working up the results of his two Amazonian trips, with the aid of two assistants, Mr. O. A. Derby and myself. His reports were published, as soon as finished, in the journals of several scientific societies. During this time he also gave popular lectures on Brazil, in New York, Boston, and Syracuse.

But Prof. Hartt was unable to continue long in this state of comparative quietude. In bringing together the results of his several trips to South America, with the object of explaining the geology of all Brazil, he saw how meagre were his data for this purpose, notwithstanding all that he and others had recently done, towards elucidating the structure of many portions of this vast region. He wished to extend his researches, and conceived the idea of organizing a survey of the whole Brazilian Empire, which has an area scarcely less than that of the United States. There was only one way of accomplishing such an undertaking; it must be supported by the government. Hartt ventured to bring the matter to the attention of some of his Brazilian friends, and his ideas met with such favor that, in 1874, he received an unofficial invitation from the Brazilian Minister of Agriculture, to submit a proposition for the systematic geological exploration of the Empire. In August of the same year he accordingly went to Rio de Janeiro, for the purpose of formally presenting his plans. Upon arriving at that city he was received with almost as much enthusiasm as was Prof. Agassiz nearlytenyears earlier. He was honored for the good he had already done Brazil through his private explorations; he was elected to the several Societies of Science and Literature in Rio de Janeiro, and invited to lecture. His thorough acquaintance with the language of the country enabled him to communicate freely with the people, and he soon found himself encircled with friends, who gladly gave their influence in advancing his laudable plans.

In his proposition for the Survey of Brazil, he advised the organization of a large party, to consist of three separate divisions, each complete in itself, and equipped for field research. Had his ideas been fully carried out he would have soon explored an immense tract of country, but the money requisite for so extensive an undertaking could not at that time be appropriated, and Hartt was forced to begin on a much smaller scale than he had wished. On the 1st of May 1875, "A Commissão Geologica do Imperio do Brazil" was organized with Professor Hartt as chief, and the following assistants: Elias F. de P. Jordão, Engineer; O. A. Derby and Richard Rathbun, Assistant Geologists; and F. José de Freitas, particante. Sñr. Marc Ferrez, photographer of the Imperial Navy, was appointed to the same position on the Geological Survey, where he was retained for a year and a half. Mr. John Branner was soon added to the corps. Sñr. Jordão retired from his position in the spring of 1876, and was succeeded by Mr. Luther Wagoner, who resigned in July, 1877. Mr. Frank Carpenter then became the engineer of the Survey, and continued in this capacity to the time of the death of Prof. Hartt. Mr. Derby and myself arrived in Brazil only at the close of 1875. No other changes than the above occurred in the personnel of the Commission, and the difficulties constantly attending the exploration of such a large country, with so small a staff, can be readily imagined.[1]

When the National Museum of Rio de Janeiro was entirely remodeled, in 1876, the Minister of Agriculture, having the matter in charge, solicited Prof. Hartt's assistance, and, at the same time, made him director of the department of Geology; but his many other duties soon forced him to relinquish the new task.

Prof. Hartt's plan of operations was to first make a preliminary reconnaissance of all the accessible portions of the Empire, before entering much into detail work; but, as will be seen in the sequel, he succeeded in very thoroughly investigating some of the regions he explored. The following general account of the explorations of the Brazilian Survey is based in part upon some of Prof. Hartt's unpublished general reports. Regarding the character of the work Prof. Hartt states in one of his late reports to the Minister: "As is the duty of every scientific man, I have carried on my investigations in a purely scientific way, hoping that later on they would not fail to be of practical importance." While awaiting instructions, Hartt visited the gold regions of São Gonçalo and Campanha. An account of the results of this trip was published in the American Journal of Science and Arts for June, 1876.

The active work of the Commission began in June, 1875. They explored the Cretaceous deposits near the coast, from Pernambuco to Parahyba do Norte, taking Maria Farinha, where Cretaceous fossils were found in 1870, as a basis. This formation was found to be very extensive and richly fossiliferous. With the marine fossils of Maria Farinha were discovered the remains of a large species of crocodile;

[1] It is most fitting to mention here the name of Major O. C. James, of Rio de Janeiro, the oldest and most valued friend of Prof. Hartt in Brazil. From the first day Prof. Hartt arrived in that country to the time of his death, he was constantly indebted to Major James for assistance and advice, and to him, in large part, was due the successful organization of the Geological Commission, for which he acted in the capacity of Secretary, his services being rendered gratuitously. His long experience in Brazil made him an invaluable auxiliary to the Commission, and he labored for it indefatigably.

at Iguarassú were found beds with fish teeth, mostly sharks, and also some reptilian teeth. To the west of the Cretaceous, and not far from the coast, is the gneiss zone. The coast southward to Cape St. Agostinho, Rio Formoso, the island of Sto. Aleixo, and the Rio São Francisco, to and including the beautiful falls of Paulo Affonso, were all examined, and on the latter river fossils were discovered in the Cretaceous formation. Extensive studies were made on the sandstone reef of Pernambuco, and the coral reefs of Candeias, Maria Farinha and Parahyba do Norte, from which were obtained large collections of corals and other marine animals, and Sñr. Ferrez was very successful in taking photographs of all the interesting places and objects. At the close of the above series of explorations, a large part of the specimens and photographs, illustrating the results of the work, were prepared for the National Exposition at Rio, in December, 1875, at which Prof. Hartt had the honor of lecturing in the presence of the Emperor. A series of these photographs were also exhibited in the Brazilian Department of the Philadelphia Centennial Exposition.

In the beginning of 1876, while one party was exploring the province of Sergipe, another was examining the geology and reefs of the bay of Bahia and vicinity. From the Cretaceous formation along the line of the Bahia Railroad were obtained a great abundance of fossil remains, among which were the genera Lepidotus and Pisodus of fishes, and Crocodiles and Dinosaurs, etc., of reptiles. The diamond gravels of Camassarí and Pojuca, near Bahia, were found to consist in large part of a rock resembling itacolumite, which, though not observed *in situ*, probably exists somewhere in the neighborhood. The large and, until that time, unexplored island in the bay of Bahia, called Itaparica, was examined and proved to be composed entirely of fossiliferous Cretaceous rocks, similar to those on the north side of the bay. On the Rio Itapicurú, in northern Bahia, the Post-Tertiary deposits yielded bones and teeth of the Megatherium, Mastodon, a very large species of Capavara (Hydrochœrus), etc. In Sergipe, the geology of all the region between the sea coast and the Serra of Itabyana was investigated. This proved to be an interesting section of country, as its structure is quite varied. The Serra of Itabyana, which can be seen from the coast, consists of beds of sandstone, conglomerate, and limestone, dipping strongly toward the east, and probably of Palæozoic age, though yielding no fossils. Between the serra and the sea is the most interesting Cretaceous basin of the coast of Brazil, valuable, not only for its scientific riches, but also for the fertility of its soil, which arises from the decomposition of limestones. The collection of fossils obtained from this Cretaceous area was probably larger than that from Pernambuco, and comprises Teleostean and Selachian fishes; several forms of Crustacea; Nautilus, Ammonites, Ceratites, Natica, Turrilites, Turritella, Janira, Ostrea, Trigonia, Cardium, Astarte, Mytilus, Gervillia, Pectunculus, Posidonomya, etc., among the Mollusca; Corals, Echini, a single large specimen of star-fish, etc., etc.

Mr. Branner spent two months in studying the geology and other natural history features of the island of Fernando de Noronha, which differs entirely in structure from the main-land, being of volcanic origin, and furnishing splendid illustrations of dykes and basaltic columns. Mr. Branner's work was fully illustrated by a fine series of photographs and sketches. At this time I was exploring, with the photographer, the southern coast of Bahia and the Abrolhos region. A large set of photographs of the Botocudo Indians was made by Sñr. Ferrez on this expedition, and forms a valuable contribution toward the study of that tribe.

During the latter half of 1876 and the first half of 1877 explorations were carried on in the southern coast provinces, as follows: in Santa Catharina by Prof. Hartt and Mr. Wagoner; in Paraná by Mr. Wagoner; and in São Paulo by myself. In Santa Catharina the regions investigated were the Carboniferous basin of the Tubarão, never before visited by a geologist, the "*sambaquis*" of Laguna, and the geology around the São Francisco do Sul. Many perfect skulls, ornaments, axes and other stone implements, and pottery were obtained from the "*sambaquis*". Mr. Wagoner made a geographical examination of the highlands west of the bay of Sta. Catharina, and from the Rio Itajahy to Coritibanos. The identity in structure of the Serra Geral and the Serra do Tubarão was proved. The fossils found in the Serra seem to be Carboniferous.

In São Paulo, I studied the metamorphic rocks from the Serra do Mar to the Serra do Mantiqueiro and beyond; the deposits of trap furnishing the "*terra roxa*," the rich land of the coffee region; the beginning of the Carboniferous basin in the south of São Paulo, containing remains of Saurians (?); and the "*sambaquis*" of the vicinity of the city of Santos. Mr. Wagoner's trip in Paraná was from Antonina, near the coast, to a point far into the interior of the province, passing Guarapuava where coal had been found. In the interior he discovered Palæozoic rocks with many fossils whose exact age has not yet been determined. The genera of Brachiopods represented are Discina, Spirifera, Strophodonta, Streptorhynchus, Leptocœlia (?), etc.; a small Ophiuran was very abundant. To complete the scientific work done to the south of Rio de Janeiro in connection with the Geological Commission, we must add the scientific results of a trip made by Mr. J. E. Mills to the gold regions of Rio Grande do Sul, of which a report was kindly furnished Prof. Hartt. Mr. Mills also contributed a very valuable report on the gold regions of Minas Geræs.

From July 1876 to February 1877, while the above described explorations were in progress to the south of Bahia, Mr. Derby was arriving at most important results in the valley of the Amazonas, which region he was well fitted to investigate, by reason of his former experiences there. He was accompanied by Sñr. Freitas and Mr. H. H. Smith, the latter of whom had already spent two years on the Amazonas in studying its entomology and the geology of several sections. The most valuable, connected series of explorations by the Commission were those executed by this small party. They examined the Ereré-Monte-Alegre district, the Rio Mæcurú, wholly unknown to science, and the Rios Curuá and Trombetas, making maps of the entire region. Mr. Smith alone worked up minutely the district lying between Alenquer and the Mæcurú, and reëxamined the Carboniferous of the lower Tapajos. There was demonstrated to exist to the north of the Amazonas a large series of Palæozoic fossiliferous rocks, including the Upper Silurian, Devonian and Carboniferous. The most important discovery was, that the Carboniferous of the lower Tapajos, and that of Maué-assú, extend to the north of the Amazonas, from the Trombetas far to the east of Monte Alegre. This fact is proved to a certainty by the stratigraphy of the beds and by their fossils. The same species of fossils that occur at Itaitúba were found on the Trombetas and Curuá, in the district of Cujubim, and in Tajury. The existence of a Carboniferous basin on the Amazonas, occupying an immense area, is thus settled beyond doubt; but the important question, "does it contain coal?" has not yet been answered. The region is generally so covered with a dense vegetation, and so level, that it is next to impossible to find any exposures of rock, except about the falls of the principal tributaries. On the Mæcurú and Curuá, to the north of Ereré, was found a rich Devonian fauna, differing only slightly from that already known from the latter locality. The Upper Silurian fossiliferous beds consist of compact flaggy sandstones, with shaly partings containing *Arthrophycus Harlani.* In the sandstones are found *Lingula cuneata, Orthis hybrida, Bucania trilobata,* etc. Mr. Derby also examined the metamorphic regions both to the north and south of the Amazonas, the shell heaps of Taperinha and the mounds of Marajó, and will probably soon publish his results in full.

The details already given tell but half the story of the field work of the Geological Commission of Brazil. Immense geological, zoölogical, and ethnological collections had been sent in from all directions, amounting to nearly six hundred cases, which were deposited in a store-house in Rio as fast as they were received. It became necessary to examine and study these collections, so as to supplement and complete the studies made in the field, and a single large room was awarded the Commission for this purpose. The task of opening and arranging this flood of rich material fell upon me, and I soon found that the one room, large as it was, would not properly contain one-tenth of the collections. A large house was requested and finally secured, and conveniently served as a museum, and as a biological, chemical, and photographic laboratory.

In June, 1877, prompted by motives of economy, and unacquainted with the amount and value of the work being done by the Commission, Government gave orders for the temporary suspension of the Survey on the first of July. After the Minister of Agriculture and other powers, however, had been convinced of the loss Brazil would sustain by suddenly discontinuing such an important undertaking, instructions were issued to have the work go on in Rio, at least until the close of the year. The Emperor, soon after returning to Rio (in the autumn of 1877), fresh from the museums of the Old World and North America, carefully inspected the building and work of the Geological Commission. He was astonished to find that the small party which he had left eighteen months before, laboring quietly among the rocks of the north of the Empire, had built up in his own capital just such a laboratory of science as he had enjoyed tarrying in in the many scientific centres he had lately visited. He showed a just appreciation of the value of the new Museum of Geology, both to his own country and to the world at large, and he was generous in his words of praise to the talented chief, who had so dearly earned them. On leaving the building, almost the only thing he said was, "your work *shall* continue."

During the early part of last January, an entire change was made in the Ministry of Brazil, and before the several departments had been entirely reorganized and the appropriations determined upon, Prof. Hartt died. There was no one to succeed him, and his large collections were placed in the care of the National Museum at Rio de Janeiro. It is expected that steps will be taken by the Brazilian Government at an early date toward publishing the many reports which were finished under the direction of Prof. Hartt. The extent of these and of the work done by the members of the Commission in Rio, from July 1877 to January 1878, can be best understood from the final report of Prof. Hartt, made to the Minister of Agriculture last December, an English translation of which is appended to this paper.

The following brief account of the state of systematic geology in Brazil, at the time of Prof. Hartt's death, will assist us in understanding what he had accomplished in that important branch of research since the publication of his book in 1870. The scanty material on this subject in my possession, necessarily renders this summary very incomplete.

Eozoic. — In distribution about as before stated. Every effort was made to find traces of *Eozoon*, or of other fossils, in the limestones of this age, in the provinces of Rio de Janeiro and São Paulo, but without success.

Lower Silurian. — The metamorphic deposits, lying on the southern edge of the plateau of Guyana and on the northern edge of that of Brazil, and consisting in large part of gneisses, and also of only partially metamorphosed quartzites, which still show stratification, and wind and wave structure, have been referred doubtfully to the Lower Silurian. To the north of the Amazonas they have been examined on the Trombetas; to the south of the Amazonas, on the Tapajos and, doubtfully, on the Tocantins. (Observations by Mr. Derby and others). The gold-bearing rocks of Minas Geræs are probably of this age, as well as the metamorphic series of some of the other provinces.

Upper Silurian. — Includes the sandstones and shales underlying the Devonian, to the north of the Amazonas, and containing *Arthrophycus Harlani, Lingula cuneata*, etc. (Derby.)

Devonian. — The heavy series of sandstones, sandy shales, etc., with an abundance of fossils at localities on the Mæcurú and Curuá, (Derby), and at Ereré, are equivalent to about the Corniferous and Hamilton groups of New York state. There are higher beds of shales with *Spirophyton.* (Derby.) Shales with *Spirophyton* near Itaitúba, Tapajos, and without fossils on the Xingú, possibly belong to the Devonian. To the north of the Amazonas the Devonian formation has been doubtfully traced as far west as the Rio Negro. (Rodriguez and Derby.) The Palæozoic fossils from the interior of Paraná are either Devonian or Carboniferous.

Carboniferous. — The large area underlaid by this formation on the Amazonas, was in part marked out in the preceding pages. Carboniferous rocks have been found on the Rio Negro and doubtfully in the province of Maranhão. In southern Brazil the extent of the deposits of this age is very great, ranging through São Paulo, Paraná, Santa Catharina and Rio Grande, and containing numerous seams of coal. Fossils are abundant in some places.

[The partially metamorphosed deposits, forming the Serra of Itabyana and other neighboring serras, are probably Palæozoic. They overlie the gneiss unconformably: other more or less metamorphosed deposits have been referred to the Palæozoic.]

Triassic (?). — Extensive series of sandstones overlaid by trap on the Serra of Sta. Catharina, and inland toward the Rio Paraná. Also doubtfully found in Sergipe.

Cretaceous. — Rio Purus, Upper Amazonas; sandstones overlying the Devonian of Ereré, with dicotyledonous leaves, probably Cretaceous; Braganza, province of Pará, discovered by Sñr. Penna; Ceará; skirting the coast from near the city of Pernambuco to Parahyba do Norte; Province of Sergipe near the sea-coast; Rio São Francisco, at several localities; Bahia de Todos os Santos; Abrolhos Islands, etc. It is possible that the Jurassic period is represented at some of the above localities.

Tertiary, with fossils on the Rio Marañon, and possibly at other localities; also the unfossiliferous deposits before enumerated.

Post Tertiary. — Lagoa Santa; interior of Bahia; Espirito Santo, etc.

Drift. — The glacial drift is probably limited to southern Brazil.

In addition to the voluminous reports prepared by Prof. Hartt as chief of the Brazilian Survey, he also had the following works, which were written before he went to Brazil in 1874, nearly or quite ready for publication.

I. *Brazilian Antiquities* — about 500 pages, 4to, with about 50 heliotype plates and many engravings.

II. *Mythology of Brazilian Indians* — about 300 pages, 4to.

III. *Grammar, Dictionary, and Chrestomathy of the Tupí Language, Ancient and Modern*, 400 pages.

IV. *An Album* of about 100 photographic views, illustrating the country, people, etc., of the Lower Amazonas. To be accompanied by about 100 pages of text.

The preceding review of the scientific work of Prof. Hartt, though very incomplete, indicates how untiring must have been his industry. In order to judge of the real character and value of his investigations, we must refer to his publications. These, however, give us but a glimpse of the vast store of knowledge he had accumulated. He has left a number of volumes in manuscript which, when published, will add greatly to his scientific standing, by making known to the world the variety and excellence of the work he had accomplished. Until then, only the few scientific associates who knew him intimately can award to him his just merits.

Hartt possessed in a high degree the qualities requisite to form a successful leader. He could plan effectively, directing his scattered forces with little effort and to the best advantage. He displayed the greatest skill in utilizing the diverse results from many sources, never, however, losing sight of the grand whole he was seeking to build up. He belonged to the modern school of Evolution, the theories of which had been sufficiently proved to him by many of his studies, and from these he obtained his great inspiration. Judging from his brilliant beginning, we are confident in asserting that, had he lived, he would have won for himself a place by the side of such investigators as De le Beche, Murchison, Logan and others, like whom he was a pioneer in the special field of research he had entered. In the following report we have in his own words an account of his Brazilian work from July 1, 1877, to January 1, 1878.

"During the past six months the members of the Geological Commission have been quite exclusively employed in laboratory work in the building of the Commission in the Côrte, the aim being to obtain before the end of the year the largest possible results from the discussion of the material collected to illustrate the geology of the region explored, and at the same time to put this material in the best possible order.

"It is but seven months since the Commission entered the house it now occupies, and has had space and facilities for opening and arranging its collections of rocks, fossils, minerals, etc. In April last it occupied a single room in the building of the Carta Geral, and only an insignificant part of the collection was accessible for study. Since then some four hundred boxes of specimens have been unpacked, the latter having been more or less carefully prepared and arranged in such a way as to be readily found when wanted. The manual labor alone involved in preparing and arranging all this material for study was in itself a gigantic task. So large is the number of specimens that I have not attempted to determine it exactly, but I estimate it roughly as much above five hundred thousand, so that the collections of the Commission form a large museum, and one of the highest value to science, because its material is unique; and I am sure that its money value to-day, if offered for sale, would more than equal the whole sum expended on the Commission.

"On leaving the field to take up the more difficult and nice work of the laboratory, it is the duty of the geological explorer to prepare his reports on the district he has examined, his material being his note-books and his collections of rocks, fossils, etc. The study and identification of collections, especially of fossils, is tedious and difficult, and can only be carried on rapidly and successfully where one has access to first-class libraries and geological collections, and where one may enjoy intercourse with scientific specialists. Indeed, unless one has made a specialty of the study of the groups of fossils he has collected in the field, even the most experienced geologist of Old World and American surveys is accustomed to hand over for description to specialists at home or abroad the collections he has made, and this recently was the case with the English 'Challenger' expedition, whose material has been distributed for study among the scientific men of the globe, and several years must elapse before the reports will have been handed in. The work of reducing scientific observations is slow and tedious, if conscientiously done, and it cannot be hastened without detriment to its accuracy; and scientific work, if not accurate, is worthless.

"The Geological Commission of Brazil found itself, on returning from the field, with an immense mass of most valuable material, for the most part new, and without a scientific library, without access to museums, and separated by an ocean from specialists in its various departments. The idea of working up palæontological and geological results under these conditions, and of presenting reports on a par of excellence with those of other geological commissions would seem utopian to foreign scientific men, and I should never have undertaken the work had not my knowledge of the country enabled me to fore-see results and to prepare myself and my assistants beforehand for the probable work before us. Except for several years of preparatory work in the United States, the consulting of the best libraries and museums and the taking of advice of scientific men eminent in specialties likely to be of use in Brazil, and but for the fact that each man came to his work furnished with abundant notes and books, it would have been impossible to have done more than prepare mere broad descriptions of the parts of the country explored, and anything like the critical study of fossils, and the accurate determination of formations would have been absolutely impossible. All this preliminary work, so exceedingly important to the Geological Commission, has cost nothing to government. Instead of being forced to send collections to foreign scientific men for study, the Geological Commission has been able, in its own laboratories and with its own resources, to prepare for publication a very considerable part of its results, though this work has naturally progressed much more slowly than it would have done under superior advantages. My great desire has been to lay a firm foundation for Brazilian geology in the development of palæontological localities and the accurate determination of characteristic formations by means of fossils, and to this end the Commission has labored with a degree of success surprising even to myself, and we find ourselves to-day with an *embarras de richesses.* The Commission as at present constituted comprises only six persons, on whom has fallen all this work of collecting, arranging, and studying this material, which in richness is to be compared with that of the 'Thayer,' or 'Hassler,' or 'Challenger' expeditions; and it is not reasonable to expect that, without free access to scientific libraries, and to collections for comparison, the work of the Brazilian Commission should go on more rapidly than that of the foreign commissions where the material is divided up among dozens of specialists, and where the scientific man enjoys every advantage. As it is, it will be several years before the full results of these commissions are prepared for publication. For six persons to unpack, assort, prepare, and describe the immense collections made by the Geological Commission in less than one year, was an absolute impossibility, as every scientific man will agree with me, and in the six months generously granted me after the suppression of the Commission by the Camaras I had only the hope of saving as large a fragment as possible of our results. It is needless to say that it has been entirely out of our power to finish the work, notwithstanding that the members of the Commission have worked unceasingly day and night on their herculean task. Neither is the discussion of the material finished, nor are the collections fully determined or arranged. Everything possible has been done, but the work is not ended. I should state that I have been compelled by circumstances to adopt a system which I otherwise would not have followed. If, to begin with, I had had ample laboratories in the Côrte and facilities for study, I should have from time to time recalled assistants, as their field work in certain localities was concluded, to work up their results in the laboratory, and this work would have gone on with the work of the field; but not having sufficient room in the Côrte for the Commission, I was compelled to store away in a warehouse the hundreds of boxes of specimens sent by my assistants, and when the present house was taken, I found it necessary to recall my whole force in order to commence the systematic study of our results. We had scarcely begun this work when field work was put a stop to at the end of July, and since then we have been confined to the reduction of our reports.

"Since the end of July the whole of the collections have been examined, great numbers of specimens have been prepared and mounted by Messrs. Derby, Rathbun, Freitas and Branner, and some have been restored or reproduced in plaster by my preparador; the condition of the collection and its classification has been steadily improved, and it has been constantly under the most careful inspection to prevent injury by rats and cockroaches, which, without constant vigilance, destroy specimens and preparations, and injure or destroy labels. In no other geological museum that I have examined are collections better cared for or in better shape for work than ours. So immense, however, is the collection, and so abundant is it in new species, that only a small part is accurately determined and arranged, the rest bearing only general labels. In case of a suspension of the Commission and the dispersion of its members before an opportunity can be found to study and accurately determine these collections by the assistants who gathered them together, a very large part of this unworked-up material will lose a large part or the whole of its value; for, like the brief notes of a field note-book, their whole significance can only be understood by the one who made them.

"Besides the work of preparing and arranging the collections, the work of the Commission during the latter half of the year 1877–78 has been as follows:—Besides the general direction of the work of my assistants, I have devoted myself to the preparation of a long report on the Geology and Physical Geography of the Lower Amazonas, embracing all my work previous to the establishment of the Commission, together with the studies in the service of the Commission of Messrs. Derby, Freitas, Smith and Penna. This report, illustrated by numerous maps and drawings, is to be followed by extended papers by Messrs. Derby and Rathbun describing the whole of the fossils of the Silurian, Devonian, and Carboniferous of the Amazonas. This report, prepared in English, and forming in itself a large volume, is nearly translated, and will be ready to be submitted in a little more than a month, and it will be found to be the most important contribution ever made to South American geology. I have pressed the preparation of this work, not only on account of its immediate scientific importance, but because our facilities for its preparation were greater than for that of any other. I have carried forward to greater or less completion several works on the reefs and harbors of the coast north of Rio, and an extended memoir on the archæological collections of the Commission, and the "*sambaquis*" of the coast. Recently I have been at work on the Geology and Physical Geography of the provinces of Pernambuco, Alagoas, Sergipe, and Bahia, including the lower São Francisco, discussing the question of the *secca* in those provinces. This voluminous report will require yet some time for its completion. Mr. Derby has occupied himself almost exclusively with his Amazonian work, geological and palæontological, and his explorations in Bahia and Sergipe. About two months ago, as he was suffering from fever contracted on the Amazonas, I sent him to São Paulo where he made, especially in the Sorocaba district, a valuable series of observations confirmatory of, and additional to, those of Mr. Rathbun. This last assistant has prepared an extended report of his excursion to São Paulo, giving the first intelligible detailed account of the geology of that province. He has finished his work on the geology of Bahia, on the coral reefs of that bay, and has concluded the corals and radiates collected by the Commission, which he has illustrated by a splendid series of photographs by his own hand, which is not equalled by any similar work that I have ever seen. I have already alluded to his studies of the Amazonian fossils. Mr. Branner has been busily engaged in the preparation and mounting of the Cretaceous fossils collected by Dr. Freitas and himself, in the provinces of Sergipe and Pernambuco, and in the preparation of a series of reports on the island of Fernando de Noronha, on the reefs of the north coast, and on a journey made by him to the interior of the province of Pernambuco, etc.

"Mr. Carpenter has been engaged in the reduction of the geographical observations of the various members of the Commission, in the preparation of a new map of the Lower Amazonas, in the revision of a paper on meteorology presented by Mr. Wagoner, and recently in the preparation of a carefully considered exposé of the methods employed by the United States Government in geographical surveying in the western territories and states, — methods sufficiently accurate, and especially adapted for a new and unexplored country, and most admirably adapted for a geological survey, where geographical and topographical work must to a certain extent be subordinated to the needs of geological exploration. Mr. Carpenter, after a severe training as a civil engineer, was employed by Lieut. Wheeler on his survey, under the War Department, of the western territories, and has had several years of practical experience in the field. I have thought that, even if the Geological Commission of Brazil should be definitely stopped, his paper would be one of the most valuable contributions that the Commission could make to Brazilian geographical and geological science. A few years ago Mr. Carpenter published in the United States a very short article on the same subject, which for its novelty and its clearness attracted very general attention. The memoir written for the Commission is a very much more extensive and valuable document, presenting for the first time clearly the methods chosen after long experience by the United States Government for the exploration of a region almost identical with Brazil in its leading features, and which has been sanctioned by the most eminent of explorers.

"Dr. Freitas, though suffering from the effects of his journey on the Amazonas, has continued faithfully to perform his arduous duty of translating into Portuguese the palæontological reports of Messrs. Derby and Rathbun. I cannot speak in too high praise of his fidelity and industry. As it was simply impossible for one person to translate the material rapidly accumulating from the different members of the Commission, I found it necessary to call in the aid of my friend, Dr. Americo dos Santos, who, during the last two months, has done everything in his power to aid in the work, translating carefully the memoir of Mr. Carpenter and various papers embraced in the voluminous relatorios on the Lower Amazonas.

"In accordance with the custom of other commissions and museums, I have employed an experienced Italian artist as a preparador of specimens, and for the making of casts and reproductions of rare fossils and antiquities to be sent abroad, and about one thousand reproductions in plaster-paris are nearly ready for distribution, and I feel sure that this work will be most highly appreciated abroad, especially at this time when American antiquities are sought for with so great an avidity."

The following list of the scientific publications of Prof. Hartt has been made as complete as the material to which I have had access permitted.

1. The Gold of Nova Scotia of Pre-Carboniferous Age. Canadian Naturalist, I, No. 6, 459–461, 1864.

2. Observations on the Geology of Southern New Brunswick, made principally during the Summer of 1864, by Prof. L. W. Bailey and Messrs. Geo. F. Matthew and C. F. Hartt; prepared and arranged, with a Geological Map, by L. W. Bailey, A.M. Contains the three following special reports by C. F. Hartt:—

(a) Preliminary Notice of a Fauna of the Primordial Period in the Vicinity of St. John, N.B., pp. 30–31. (Published also in Can. Nat., VII, 318–320, 1865; and in Dawson's "Acadian Geology," 2d Ed., 1868, 641–643.)

(b) On the Devonian Plant Locality of the "Fern Ledges," Lancaster, New Brunswick, with a detailed Section, and Notes on the Fossils, 131–141. (Includes report of S. H. Scudder on the Devonian insects. An abstract was published in "Acadian Geology," 1868, 513–523.)

(c) List of New Brunswick Fossils, 143–147.

3. The Recent Bird-Tracks of the Basin of Minas. American Naturalist, I, 169–176, 234–243, 1867.

4. On a Sub-division of the Acadian Carboniferous Limestones, with a Description of a Section across these Rocks at Windsor, N. S. Can. Nat., III, 212–224, 1867. (A summary of the results recorded in this paper are given in "Acadian Geology," 1868, 279–280.)

5. [Descriptions and Notices of the Trilobites and other Fossils of the Acadian Group, at St. John, N. B.] "Acadian Geology," 1868, 643–657, with many figures. (Prepared by Dr. Dawson from the MS. notes of Prof. Hartt.)

6. Résumé of a Lecture on the "Growth of the South American Continent," delivered before the Library Association, Ithaca, N. Y., Dec. 4, 1868. Cornell Era, Dec. 12, 1868. (Pamphlet reprint contains 8 pages.)

7. A Vacation Trip to Brazil. Amer. Nat., I, 642–651, 1868.

8. A Naturalist in Brazil. Amer. Nat., II, 1–13, with illustrations, 1868.

9. The Cruise of the "Abrolhos." Amer. Nat., II, 85–93, with illustrations, 1868.

10. On the Botocudos of Brazil, (abstract). Proceed. Amer. Ass. Adv. Sci., 18th meeting, Salem, 1869, 273–274.

11. Thayer Expedition.—Scientific Results of a Journey in Brazil, by Louis Agassiz and his Travelling Companions.—Geology and Physical Geography of Brazil, by Ch. Fred Hartt, with illustrations and maps, 8°, pp. 620. Boston: Fields, Osgood & Co., 1870.

12. Discovery of Lower Carboniferous Fossils on the Rio Tapajos. (A letter written near Monte Alegre, Rio Amazonas, Oct. 5, 1870). Amer. Nat., IV, 694–695, 1871.

13. Devonian Rocks in the Amazonian Valley. Amer. Nat., V, 121–122, 1871.

14. Amazonian Drift. Amer. Journ. Sci. and Arts, I, April, 1871, 294–296.

15. Brazilian Rock Inscriptions. Amer. Nat., V, 139–147, with 9 plates, 1871.

16. The Ancient Indian Pottery of Marajó, Brazil. Amer. Nat., V, 259–271, with numerous figures, 1871.

17. Recent Explorations in the Valley of the Amazonas, with Map. Journ. Amer. Geog. Soc. N. Y., III, 1872, 231–252, (read May 16, 1871).

18. [The Origin of the Basin of the Amazonas (abstract).] Proc. Boston Soc. Nat. Hist., XV, 153–154, 1872.

19. On the Tertiary Basin of the Marañon. Amer. Journ. Sci. and Arts, IV, July, 1872, 53–58.

20. On the Occurrence of Face-Urns in Brazil. Amer. Nat., VI, 607–610, with one large figure, 1872.

21. Notes on the Lingoa Geral or Modern Tupí of the Amazonas. Trans. Amer. Philolog. Ass., 1872, pp. 20.

22. O Mytho do Curupira. Aurora Brasileira, Ithaca, N. Y., Oct. and Nov. 1873. (Also separate reprint, pp. 12.)

23. Morgan Expeditions, 1870–71. — Contributions to the Geology and Physical Geography of the Lower Amazonas. The Ereré-Monte-Alegre District and the Table-Topped Hills. Bull. Buffalo Soc. Nat. Sci., I, No. 4, 201-235, with maps and sketches, 1874.

24. Preliminary Report of the Morgan Expeditions, 1870–71. — Report of a Reconnoissance of the Lower Tapajos. Bull. Cornell University (Science), I, No. 1, pp. 37, with map, 1874.

25. Evolution in Ornament. Popular Science Monthly, January, 1875, 266–275, with many figures.

26. Morgan Expeditions, 1870–71. — On the Devonian Trilobites and Mollusks of Ereré, Province of Pará, Brazil; by Ch. Fred. Hartt and Richard Rathbun. Ann. Lyc. Nat. Hist., N. Y., XI, 110–127, May, 1875.

27. The Indian Cemetery of the Gruta das Mumias, Southern Minas Geræs, Brazil. Amer. Nat., IX, 205–217 (illustrated), 1875.

28. Amazonian Tortoise Myths. Rio de Janeiro, Wm. Scully, publisher, 1875, pp. 40.

29. Notes on the Manufacture of Pottery among Savage Races. Published at the office of the "South American Mail," Rio de Janeiro, 1875, pp. 70.

30. Exploraçœs Scientificas, — I. Commissão Geologica do Brazil. Catalogo da Exposição de Obras Publicas do Ministerio da Agricultura, Rio de Janeiro, 1876, 95–106.

31. Nota sobre Algumas Tangas de Barro Cosido dos Antigos Indigenas da Ilha de Marajó. Archivos do Museu Nacional do Rio de Janeiro, I, Trimestre 1°, 21–25, Estampas III, IV & V, 1876.

32. Discripção dos Objectos de Pedra de Origem Indigena conservados no Museu Nacional. Arch. do Mus. Nac. do Rio de Janeiro, I, Trim. 2° & 3°, 45–53, Estampas VII & VIII, & 2 figuras 1876.

33. The Geological Survey of Brazil. First Preliminary Report made to the Counselor Thomaz José Coelho de Almeida, Minister and Secretary of State for Agriculture, etc.; by Ch. Fred. Hartt, Chief of the Geological Commission of the Empire of Brazil, Rio de Janeiro, 1876. Translated and abridged by Prof. T. B. Comstock. Amer. Journ. Sci. and Arts, XI, June, 1876, 466–473.

LIST OF SPECIAL SCIENTIFIC PAPERS BY VARIOUS AUTHORS ON COLLECTIONS BROUGHT FROM BRAZIL BY PROF. C. F. HARTT.

1. Notice of Corals and Echinoderms collected by Prof. C. F. Hartt, at the Abrolhos Reefs, Province of Bahia, Brazil, 1867; by Prof. A. E. Verrill. Trans. Conn. Acad. of Arts and Sciences, I, 1868, 351–371, pl. iv.

2. Notice of some New Reptilian Remains from the Cretaceous of Brazil; by Prof. O. C. Marsh. Amer. Jour. Sci. and Arts, XLVII, May, 1869, 390–392.

3. Abstract of a Notice of the Crustacea collected by Prof. C. F. Hartt, on the Coast of Brazil, in 1867; by S. I. Smith. Amer. Journ. Sci. and Arts, XLVIII, 1869, 388–391.

4. Notice of the Crustacea collected by Prof. C. F. Hartt on the coast of Brazil in 1867.—List of the described species of Brazilian Podopthalmia; by S. I. Smith. Trans. Conn. Acad. of Arts and Sciences, II, pt. I, 1–42, pl. 1, 1870.

5. Morgan Expeditions, 1870–71.—On the Devonian Brachiopoda of Ereré, Province of Pará, Brazil; by Richard Rathbun. Bull. Buffalo Soc. Nat. Sci., I, No. 4, 236–261, plates 8–10, 1874.

6. On the Carboniferous Brachiopoda of Itaitúba, Rio Tapajos, Province of Pará, Brazil; by O. A. Derby, M. S. Bull. Cornell University (Science), I, No. 2, 1–63, plates I–IX, 1874.

7. Preliminary Report on the Cretaceous Lamellibranchs collected in the vicinity of Pernambuco, Brazil, on the Morgan Expedition of 1870; by Richard Rathbun. Proc. Boston Soc. Nat. Hist., XVII, 1874, 241–256.

8. The Geological Commission of Brazil.—Additions to the Echinoid fauna of Brazil; by Richard Rathbun. Amer. Journ. Sci. and Arts, XV, Feb., 1878, 82–84.

Profs. Hyatt and Niles, and Messrs. Putnam and Scudder also spoke warmly in praise of the character and learning of Prof. Hartt.

Dr. T. M. Brewer noted the recent occurrence within the limit of the state of two rare birds: *Actodromus Bairdii* and *Hydrochelidon niger*.

Rev. R. C. Waterston presented a mounted specimen of the Prairie Dog, which he had shown to the Society several years ago, and which had lived up to the past summer, having become very tame.

The following paper was presented by title: —

Notices of the Hemiptera Heteroptera in the Collection of the late T. W. Harris, M.D. By P. R. Uhler.

Through the kindness of Mr. Samuel H. Scudder, I have been permitted to examine at leisure the precious remains of the collection of Dr. Harris, now belonging to the Boston Society of Natural History.

This collection is of especial interest at the present time, because it is the only one preserved in this country which contains original and authentic types of the Hemiptera described by Mr. Say and other early American entomologists. The destruction, or dispersion, of the collections of all our earlier entomologists left wide gaps in the knowledge of their types, which could only be filled by a study of the specimens of Dr. Harris. Much damage has occurred to the specimens, and a few have been entirely destroyed by the voracity of Trogoderma and Anthrenus; but generally the parts remaining have been enough to admit of comparison and to establish identity. The present paper gives, therefore, the results of a close comparison and study of every one of his specimens, in connection with others in my own cabinet, or in those of friends who have kindly lent them to me for this purpose. It embraces, as far as possible, a reduction of the synonyms, and a reference of the species to the latest appropriate genera. Dr. Harris had carefully labelled each form and variety with a distinct number, and recorded in a manuscript catalogue such information as he had gathered respecting their habitat, time of appearance, and habits; and these notes have all been introduced in their proper places, distinguished by quotation marks.

The present list includes in all 163 species, of which 125 have been found in Massachusetts and the adjacent region, and about 35 in the Southern States.

Massachusetts has many more species than are here enumerated; but as they are not in this collection, and as no survey of her territory has yet included a systematic plan of collecting them, the materials available are too meagre at present to justify a more extended work upon the subject.

CORIMELÆNIDÆ.

CORIMELÆNA White.

1. Corimelæna atra.

Galgupha atra Amyot et Serv., Hemipt., 68, 1. *Odontoscelis unicolor* Germar, Zeitsch., I, 37, 2. *Id.* Herrich-Schæffer, Wanz. Ins., V, 12, 34, pl. 149, fig. 470. *Tetyra helopioides* Wolff, Icon. Cim., 174, pl. 17, fig. 168.

No. 148, Harris' Collection. "New York, Mr. Willcox."

This species varies somewhat in the breadth of its outline, and in the distinctness of the punctation upon the pronotum and scutellum. It is the largest thus far discovered in the United States, and is the only one of our species which agrees with the descriptions of Germar and Herrich-Schaeffer, above cited. It is the same as a specimen of *Galgupha atra* Amyot and Serville, from Mexico, kindly sent to me by Dr. Signoret. Mr. Scudder, while in Paris, obliged me by comparing my specimens with the types of *C. unicolor* Palisot Beauvois in the collection of Dr. Signoret; the result of which was that both gentlemen coincided in considering them to be different species. As the name *unicolor* is thus seen to have been previously employed by Beauvois, it becomes necessary to adopt a later one. The next name given, however, that of *C. helopioides* by Wolff, is also preoccupied, and thus we are carried to the latest, that of Amyot and Serville, as the only one available for this species. Specimens differ considerably in size and density of punctuation, and some are much more dark and dull than others. Generally, they are highly polished and have a greenish-brassy tinge.

The genus Galgupha erected for it by Amyot and Serville can not stand, as the characters derived from the size of the scutellum are neither separative nor permanent.

2. C. nitiduloides.

Cimex nitiduloides Wolff, Icones Cimicum, 98, pl. 10, fig. 92. *Odontoscelis nitiduloides* Germar, Zeitsch., I, 37, 1. *Idem.* H.-Schf., Wanz. Ins., V, 15 and 33, tab. 145, fig. 471. *Thyreocoris histeroides* Say, Heteropt.

Nos. 25 and 11. Harris' collection. "March 25, 1827; April 27, 1831; Cambridge, April, 1836; May 10, 1828; June 30, 1823; July 1825; Maine, Mr. Randall, July, August."

There are four specimens with No. 25, in the collection. One of them is a little more brassy and elongated than the others and has a decidedly impressed streak near the margin of the pronotum, but the conformity of the other characters induces me to keep it here.

Number 11 is labelled "Ohio, Ward," but it is the well known form of this species, which is common in New England, as well as in the central States.

The name "*subviridis*" was given to it by Mr. Say, but afterwards changed to *histeroides* when he printed the description.

No. 25 was determined as *histeroides*, for Dr. Harris, by Mr. Say himself.

The length given by Mr. Say to his *T. histeroides* is large enough to include also the preceding species; but, as far as our present knowledge extends, the two are sufficiently distinct.

3. C. pulicaria.

Odontoscelis pulicarius Germar, Zeitsch., I, 39, 6. *Id.* H.-Schf., Wanz. Ins., V, 34.

No. 149, Harris' Collection. "New York, Mr. Willcox."

This is a common species in Massachusetts, although Dr. Harris seems not to have had specimens from the State. It may be found, sometimes quite abundantly, in the axils of the leaves of species of Eupatorium.

PACHYCORIDÆ.

AULACOSTETHUS. New genus.

Form of *Diolcus* Mayr. Head about two-thirds as long as the width across the eyes, much shorter than the pronotum. Tylus longer than the lateral lobes, raised above the adjoining surface. Inferior cheeks blunt, convexly thick, bucculæ very slender; rostrum extending nearly to the end of the second ventral segment, the second joint subequal to the third and fourth united, the third and fourth equal. Elevated sternal flaps short, broadly rounded; the margin of the deep sternal sulcus feebly elevated between the anterior and intermediate coxæ, but thicker and more elevated between the intermediate and posterior coxæ. Exterior face of tibiæ obsoletely carinate, the lateral edges acutely carinate. Odoriferous ducts very long, ligulate, reaching almost to the outward margin of the plate on which they are situated, the osteole placed more than one-half way back upon it, and from it the sulcus runs outwards to the end of the duct. Scutellum a little humped at base, gradually declining posteriorly. Edge of connexivum subacute.

A. marmoratus.

Tetyra marmorata Say, Heteropt. New Harm., 2, 1. Fitch repr. Trans. N. Y. State Agricult. Soc., 1857, p. 755. *Aulacostethus marmoratus* Uhler, Proc. Boston Soc. N. H., 1871, p. 94.

No. 112, Harris' Collection, ♂. "North Carolina, April, Mr. Nuttall." Determined by Mr. Say.

Mr. Say's specimens were obtained in New Jersey. A male in my collection, from near Baltimore, is much smaller than that of Dr. Harris, but differs in no other respect.

Homæmus Dallas.

H. æneifrons.

Scutellera æneifrons Say, Long's Exped., Appendix, 299, No. 2. *Pachycoris exilis* H.-Schf., Wanz. Ins., IV, tab. 110, fig. 346.

Not included in the original manuscript index of Dr. Harris; but there are two specimens in the collection. It is not uncommon in Eastern Massachusetts, near Andover, and in other localities. In Maryland it is one of the forms belonging to the Alleghanian Fauna, being replaced in the Carolinian District by *Homæmus parvulus* Germar.

EURYGASTRINA.

Eurygaster Lap.

E. alternatus.

Tetyra alternata Say, Amer. Entomol., tab. 43, fig. 3. — Germar, Zeitsch., I, 74, 5.

No. 34, Harris' Collection, ♂ and ♀. "May 30, 1826. April 22, 1829. Cambridge, July 10, 1836."

This species occurs from Eastern Canada to Oregon and California; it is common in Illinois and Massachusetts. Specimens were obtained by Mr. Kennicott near Great Slave Lake, and I have met with two or three individuals in Maryland. It varies in color about as much as its European congener; being found of all the shades from light olive-gray to dark ferruginous.

PODOPINA.

Podops Lap.

P. dubius.

Scutellera dubia Beauv., Ins. Afr. et Amér., Hemipt., 33, pl. 5, fig. 6. *Tetyra cinctipes* Say, Amer. Ent., III, pl. 43, fig. 4. *Podops dubius* Germ., Zeitsch., I, 64, 2. H.-Schf., Wanz. Ins., V. 44, tab. 158, fig. 495.

No. 55, Harris' Collection. "April 20, 1822, April 15, 1829. May 15, 1829." Determined as *T. cinctipes* by Mr. Say.

There is much variation in the size of the specimens. The species is common in Massachusetts, abundant in Illinois, and not rare in Louisiana. I have occasionally found specimens near Baltimore, beneath stones; sometimes as late as November.

ASOPINA.

Stiretrus Lap.

St. fimbriatus.

Tetyra fimbriata Say, Amer. Ent., III, tab. 43, fig. 1. *Asopus variegatus* H.-Schf., Wanz. Ins., IV, 90, tab. 137, fig. 427. *Stiretrus fimbriatus* Germar, Zeitsch., I, 16, 3.

No. 30, Harris' Collection. "Flowers of *Asclepias pulchra*, August 10, 1825, July 25, 1831." Determined by Mr. Say as his *Tetyra alternata*, but in his MS. list Dr. Harris corrects the error.

The specimens vary very much in size and colors. The two individuals in this collection are of the usual type, with yellow hemelytra and the black spot near the interior angle of the corium. A variety from Mexico is the *St. personatus* Germar ; the same variety occurs also in Pennsylvania. In Maryland it frequents *Rhus glabra* and sucks the blood of the larva of a species of Galeruca which feeds on that plant.

Perillus Stål.

1. P. exaptus.

Pentatoma exapta Say, Journ. Acad. Phila., IV, 331, 3. *Pentatoma variegata* Kirby, N. Zool., 276, 384. *Zicrona marginella* Dallas, Brit. Mus. Cat. Hem., I, 109, 5.

No. 69, Harris' Collection. "July 15, 1828." Determined as *P. exapta* by Mr. Say.

Specimens have been examined, in which the head was entirely black, or with the front or outer margins white. The pronotum is sometimes ivory-white, instead of red, and the basal black may be reduced, or even entirely wanting.

One or other of the forms of this species have been found across the whole breadth of this continent about the latitude of New England. West of the Mississippi river it extends farther south, and it has been met with in southern Missouri.

2. P. circumcinctus.

Perillus circumcinctus Stål, Hemipt. Mex., Stettin. Ent. Zeit., XXXIII, 89.

No. 115, Harris' Collection. "Sutton, Mass., Dr. Smith."

This is a variety of *P. circumcinctus* Stål, and is named *Pentatoma clauda* Say in Dr. Harris' list; and was determined by Say. It is a more robust form than the typical one of the latter author, and differs from it in various particulars unnecessary to reproduce here; but, until we have fuller knowledge of the two species, it will be more satisfactory to keep them separate.

The extraordinary range of this species is worthy of remark. It extends from the island of Trinidad, near the mouth of the Orinoco River, and from Panama to Nebraska, Canada, and New England.

Podisus Stål.

1. P. cynicus.

Pentatoma cynica Say, Heteropt. New Harm., 3, 1. *Arma grandis* Dallas, Brit. Mus. Cat. Hemipt., p. 96, 3.

No. 147. Harris' Collection. "Cambridge, Mass., September 9, 1837."

Another specimen in the collection has a printed number (400) and label, "Wilcox, New York," attached to the pin.

It is also a native of Missouri, Illinois, Pennsylvania, Maryland and New York.

2. P. modestus.

Arma modesta Dallas, Brit. Mus. Cat., 101, 13.

No. 19. Dr. Harris' Collection, ♂, ♀. "June 10, 1822."

Dr. Harris received the name *Pentatoma maculiventris* from Say, but did not know whether its description was published or not. Certainly no description of it is to be found in the printed papers of Mr. Say.

3. P. serieventris.

Podisus serieventris Uhler, Proc. Bost. Soc. N. H., 1871, p. 95.

Similar to the preceding species in form and appearance, but of a more blackish-gray color. Pronotum not so much sinuated each side, the humeral angles less prominent, obtusely triangular, blackish; the surface a little less regularly punctured, each side anteriorly and in each corner the punctures finer and confluent, presenting the appearance of four blackish spots, the anterior surface more broadly smooth, yellow. Scapus and basal joint of the antennæ blackish exteriorly. Scutellum punctured with black, the points aggregated in a large patch at base, and the basal angles with a large, smooth, whitish spot. Pectus remotely punctured with fuscous; near the middle of the sides and at the exterior tip of the osteolar sulcus black. Legs pale orange-yellow, the femora pointed with fuscous, the dots more or less aggregated beyond the middle. Corium less coarsely punctured, the punctures fuscous or rufous, those of the costal area coarser, the finer ones aggregated in small patches, the surface adjoining the median suture on its inner side, and near its tip quite smooth, embrowned; embolium yellow, with a fuscous spot at base; membrane a little tinged with brownish, the base of the nervures, basal margin very broadly, and a broad streak at tip, dark brown. Tergum with large blackish clouded spots each side and behind, the connexivum bright yellow, with a quadrangular black spot at the base and apex of each segment, on the underside with a marginal black dot at the base and apex of each segment, against the sutures; venter punctured with rufous and black, the latter arranged each side in a longitudinal series of patches; interior to these is a row of black spots, and upon the middle line four round spots, the posterior one much the largest. Length to end of abdomen $9\frac{1}{2}$ millims. Humeral breadth $5\frac{1}{2}$ millims.

No. 40. Harris' Collection, ♂. "Cambridge, Mass., April 20, 1827."

Named *Pentatoma serieventris* by Mr. Say, but never published. The inner basal angle of the membrane is very dark brown, and the apical streak quite broad at tip. A specimen from Massachusetts in my own collection is quite orange-rufous above. The lateral margins of the anterior lobe of the pronotum are quite distinctly denticulato-serrate; and pale yellow. The species is known to me from Minnesota, Maine and Massachusetts.

CYDNIDÆ.

Pangæus Stål.

P. bilineatus.

Cydnus bilineatus Say, Journ. Acad. Philad., IV, 315, 1. *Aethus bilineatus* Dallas, Brit. Mus. Cat. Hemipt., I, 119, 20. *Cydnus femoralis* H.-Schf., Wanz. Ins., V, 98. fig. 548. *Aethus Robertsonii* Fitch. sec. typ. et Signoret.

No. 135. Harris' Collection. "Florence, Ala., January and February, 1836. Prof. Hentz."

This species is widely distributed throughout the Eastern and Atlantic States, and is found as far west as Texas. Having examined the type of Dr. Fitch, I am enabled to refer it to this species. A specimen sent to Dr. Signoret of Paris was also identified by him as *Aethus Robinsonii* Fitch.

AMNESTUS Dallas.

A. spinifrons.

Cydnus spinifrons Say, Journ. Acad. Philad., iv, 316. *Amnestus spinifrons* Dallas, Brit. Mus. Cat. Hemipt., I, 126, 1.

No. 68. Harris' Collection. "Cambridge, Mass., March 28, 1828, May 15, 1831, Sept., 1831."

Was named *Cydnus spinifrons* by Mr. Say in his letter to Dr. Harris.

SEHIRUS Amyot et Serv.

S. cinctus.

Pentatoma cincta Beauv., Ins. Afr. et Amér., 114, pl. 8, fig. 7. *Cydnus ligatus* Say, Heteropt., 10, 1. *Sehirus albonotatus* Dallas, Brit. Mus. Cat. Hemipt., I, 128, 2. *Sehirus cinctus* Stål, Hemipt. Afr., I, 29. Note.

Nos. 24, 42, 132. Harris' Collection. "Cambridge, Mass., May 1, 1827; April 22, 1829; Milton; New Hampshire, Mr. Leonard; June 10, 1823, palings. ♀ Maine, May 6, 1836, Mr. Randall."

No. 24 was named *Cydnus bilineatus*, and No. 42, *Cydnus ligatus* by Say himself for Dr. Harris. Another specimen with printed label, No. 116, was obtained by Dr. Simeon Shurtleff, at Westfield, Mass.

The females usually have a sublunate white spot near the postero-exterior corner of the corium. Mr. Say appears not to have known the female of this species, for he makes the absence of the white spot a specific difference.

It spreads over almost the whole country east of the great basin, and extends into Canada and Mexico.

HALYDINA.

BROCHYMENA Am. et Serv.

1. B. arborea.

Pentatoma arborea Say, Journ. Acad. Philad., IV, 311, 1. *Halys erosa* H.-Schf., Wanz. Ins., v, 70, tab. 166, fig. 515.

No. 114, Harris' Collection, ♀ : "Sutton, Mass., Dr. Smith."

The above name is from Mr. Say.

2. B. myops.

Brochymena myops Stål, Enum. Hemipt., II, 16, No. 1. *Cimex quadripustulatus* Fab., Ent. Syst., IV, 100, 81. *Halys quadripustulata* Fab., Syst. Rhyng., 182, 9. *Ib.*, H.-Schf., Wanz. Ins., VII, 57, tab. 234, fig. 729. *Brochymena quadripustulata* Dallas, Brit. Mus. Cat., 188, 2.

No. 110, Harris' Collection, ♂, ♀. "N. Car., Mr. Nuttall, April; also Florence, Alabama. Jan., Feb. Hentz." Another specimen without a number, habitat uncertain, is in the collection.

3. Brochymena annulata.

Cimex annulatus Fab., Syst. Ent., 704, No. 38. *Halys serrata* Fab., Syst. Rhyng., 181, 2. *Halys pupillata* H.-Schf., Wanz. Ins., IV, 104, tab. 144, fig. 453. *Brochymena serrata* Am. et Serv., 107, 1.

No. 23, Harris' Collection, ♂, ♀. "On fences in Mass., Nov. 12, 1821, June 1, 1829, and June 10, 1823."

Dr. Harris confuses this species with *B. arborea*, No. 114, from which it is very distinct.

4. B. Harrisii.

Brochymena Harrisii Uhler, Proc. Bost. Soc. N. H., 1871, p. 95.

Similar to *B. annulata* Fab., but proportionately shorter and broader. Head elongate-sub-quadrate, much shorter than in *B. annulata*, the lateral margins straight and parallel; tylus a little shorter than the lateral lobes, the anterior prolongations of these lobes not much longer than the lateral projections, the exterior corner of the projections almost toothed. Pronotum proportionately shorter and broader than in *B. annulata*, the anterior lobe having the lateral teeth direct and more nearly equal in size; humeral angles obliquely rounded, elevated, with a few short, oblique, ill-defined teeth, the surface behind the angles obliquely impressed. Connexivum with a transverse black, subdepressed spot before and behind each incisure. Membrane hardly reaching beyond the abdomen, having fuscous ramifications as in *B. annulata*. Venter more convex than in *B. annulata*, the longitudinal groove continued distinctly to the penultimate segment. Femora mottled with brown, having a yellow macular ring before the tip; tibiæ brownish, with a yellow ring upon the middle. The remaining characters as in *B. annulata*.

Length, $16\frac{1}{2}$–18 millims. Humeral breadth, $9\frac{1}{2}$ millims. ♀.

In Dr. Harris' collection without a number. I possess a female from Lancaster Co., Pa., which was beaten from a tree in May.

TRICHOPEPLA Stål.

T. semivittata.

Pentatoma semivittata Say, Heteropt. New Harmony, 9, 21. *Pentatoma semivittatum* H.-Schf., Wanz. Ins., VII, 93, fig. 766. *Pentatoma pilipes* Dallas, Brit. Mus. Cat. Hemipt., I, 247, No. 37. *Trichopepla pilipes* Stål, Öfvers., 1867, 528. *Trichopepla semivittata* Stål, Enum. Hemipt., II, 34. Uhler, Proc. Bost. Soc. N. H., 1871, p. 96.

No. 89, Harris' Collection. "North Carolina, Prof. Hentz."

The above name was sent to Dr. Harris by Mr. Say. It is the nearest North American representative of the African genus *Agonoscelis* Amyot and Serv.

PENTATOMINA.

EUSCHISTUS Dallas.

1. E. variolarius.

Pentatoma variolaria Pal. Beauv., Ins. Afr. et Amér., 149, pl. 10, fig. 6. *Pentatoma punctipes* Say, Journ. Acad. Philad., IV, 314, 5. *Cimex sordidus* H.-Schf., Wanz. Ins., VI, 70, tab. 204, fig. 637. *Pentatoma sordidum* H.-Schf., ib. VII, 95. *Euschistus punctipes* Dallas, Brit. Mus. Cat. Hem., I, 207, 16. *Euschistus variolarius* Stål, Enum. Hemipt., II, 26, No. 22.

No. 32, Harris' Collection. "May 15, 1826. Wilcox?· N. Y." Printed No. 320.

Dr. Harris, with doubt, refers the specimen to *E. ictericus* Linn., to which it is certainly related, but he failed to recognize its identity with *E. punctipes* Say, with whose description it agrees in all respects. To the latter he refers a species with elongate, split head, which disagrees very distinctly with that description. Mr. Say determined it for Dr. Harris under the name "ictericus? Fab."

2. E. fissilis.

Euschistus fissilis Uhler, Proc. Bost. Soc. N. H., 1871, p. 96.

Form and general aspect of *E. servus* Say. Robust, pale yellow, finely aciculated with fuscous or black, the punctures more or less grouped together, and becoming very dense near the lateral margins of the pronotum. Head deeply cleft, caused by the prolongation of the lateral lobes, which are very much thrust forward beyond the tylus, but do not meet in front. The basal joint of the antennæ not reaching the tip of the head; second joint a little shorter than the third. Surface of the pronotum depressed each side in advance of the humeral angles; the humeral angles prominent and rounded, alike in both sexes. Corium more or less, and the membrane decidedly, dotted with fuscous. The whole inferior surface minutely sprinkled with red, the specks becoming larger on the pectus; both the underside of head and the pectus coarsely punctured. Venter polished, finely punctured. Length, 12–13 millims. Humeral breadth, 8–8½ millims.

No. 2, Dr. Harris' Collection, 2 ♂, 1 ♀. "Mass., May 30, 1826."

Dr. Harris, in the manuscript catalogue, refers this species to *E. punctipes* Say, and also makes it synonymous with *E. servus* Say. It does not agree in many respects with the descriptions of either of those species; which are easily distinguished from each other by good characteristics. In one of the males, the second joint of the antenna is longer than the third; in other respects it agrees with the normal forms of this species. Mr. Say named it for Dr. Harris as *P. serva*.

3. E. servus Say.

Pentatoma serva Say, Heteropt., 4, 5. *Euchistus servus* Stål, Enum. Hemipt., 2, 26, No. 19.

A damaged ♀ is in the collection; obtained at Westfield, by Dr. S. Shurtleff, No. 117.

MENECLES Stål.

M inserta.

Pentatoma inserta Say, Hemipt. New Harm., 6, 11. *Menecles inserta* Stål, Öfver. Vetensk.-Akad. Forhandl., 1867, p. 527.

No. 75, Harris Collection, ♂.

One specimen in this collection, without designation of the locality where found. I have examined specimens from Illinois, Kansas, Nebraska, California and Pennsylvania. This name was also sent to Dr. Harris by Mr. Say.

HYMENARCYS Amyot et Serv.

H. nervosa.

Pentatoma nervosa Say, Heteropt. New Harmony, 9, 20. *Pentatoma pennsylvanicæ* Hope, Cat. Hem., 35. *Hymenarcys perpunctata* Amyot and Serv., Hemipt., 124, 1.

No. 31, Harris' Collection, ♂, ♀. "May 15, 1836."

So determined by Mr. Say. Moderately common in Massachusetts, but found in larger numbers farther south; extending through New York, Pennsylvania, Virginia, North Carolina and Georgia into northern Florida. Two other specimens, without number or locality, are in the collection.

Cœnus Dallas.

C. delius.

Pentatoma delia Say, Heteropt., 8, 18. *Hymenarcys æruginosa* Amyot et Serv., Hemipt., 125, 2. *Cœnus tarsalis* Dallas, Brit. Mus. Cat. Hemipt. I, 230, 1, pl. viii, fig. 6.

No. 3, Harris' Collection, ♀. "April 25 and June 25, 1822."

Mr. Say communicated to Dr. Harris the name *Pentatoma obesa* for this insect, but he afterwards described it under that given above.

Neottiglossa Kirby.

N. undata.

Pentatoma undata Say, Heteropt. New Harmony, 8, 17; Complete writings, I, 319, 17. Uhler, Proc. Bost. Soc. N. H., 1871, p. 96.

No. 83, Harris' Collection. "Ipswich, Mr. Oakes."

So determined by Mr. Say. This insect belongs to *Platysolen* Fieber, but that genus must be replaced by the one here given. The species is very closely related to *P. inflexus* Wolff, of Europe, and may eventually prove to be only a geographical variety of it. In eastern Massachusetts it seems to be very persistent in its pattern of marking, but in Ohio and Illinois it varies quite appreciably.

Cosmopepla Stål.

C. carnifex.

Cimex carnifex Fab., Ent. Syst., Suppl., 535, 162. *Eysarcoris carnifex* Hahn, Wanz. Ins., II, 117, tab. 65, fig. 197. *Pentatoma carnifex* Kirby, Faun. Bor., 275.

No. 56, Harris' Collection, ♂, ♀. "N. H., Mr. Leonard. Prof. Peck's insects, and Cambridge. Randall, Dublin, N. H. ♂ on nettles, July 20, 1835. Cambridge, Aug. 10, 1835, July 25, ♀, ♂."

Mormidea Am. et Serv.

M. lugens.

Cimex lugens Fab., Ent. Syst., IV, 125, 175. *Cimex albipes* Fab., Ent. Syst., Suppl., 535. *Pentatoma punctipes* Beauv., Ins. Afr. et Amér., 113; Hem., pl. 8, fig. 6. *Pentatoma punctipes* Say, Journ.

Acad. Philad., IV, 313, 4. *Pentatoma lugens* H.-Schf., Wanz. Ins., VII, 96. *Pentatoma lugens* Dallas, Brit. Mus. Cat., 248, 39. *Cimex gamma* Fab. (substitution for *C. albipes*), Syst. Rhyng., 7, index.

No. 52, Harris' Collection. "Milton, June 1, 1829; Ipswich, Mr. Oakes. New Hampshire, Mr. Leonard. Cambridge, June, 1833. Ohio."

Determined as *Pentatcma punctipes* Beauv., by Mr. Say. It extends from Canada to Mexico, and is sometimes excessively abundant in Maryland and Pennsylvania.

Oebalus Stål.

O. pugnax.

Cimex pugnax Fab., Syst. Rhyng., 162, 34. *Pentatoma orthacantha* Beauv., Ins., 130; Hem., pl. 9, fig. 9. *Pentatoma augur* Say, Heteropt., 3, 2. *Cimex vitripennis* Burm., Handb., II, 367, 9. *Oebalus typhœus* Stål, Ent. Zeit. Stettin, 101, 68. *Mormidea typhœus* Dallas, Brit. Mus. Cat., 216, 16. *Oebalus pugnax* Stål, Enum. Hemipt., II, 22; No. 1.

No. 92, Harris' Collection. "Penna., Dr. Pickering."

Named *Pentatoma 5-spinosa* by Mr. Say. I have examined specimens of this species from various parts of the United States, south of Michigan; also from Cuba, Mexico and Brazil. It is common in Pennsylvania, Maryland, Virginia and North Carolina.

Lioderma Uhler.

Long-oval, subtriangular anteriorly. Head moderate; face a little convex, lateral lobes depressed, the margins sinuated and gently recurved, tips subtriangular, rounded, extending a little beyond the tylus; antennæ at base with a blunt tooth, which bears a smaller tooth near its base; bucculæ extending to near the base of the head, narrow, dilated anteriorly into rounded laps; rostrum reaching the abdomen, fitting into a groove of the sternum, basal joint as long as the bucculæ, second joint longest; antennæ long, slender, as long as the corium of the hemelytra, basal joint about half as long as the second, second and third subequal, fourth longer, fifth longest. Pronotum very slightly inclining anteriorly, convex, hexagonal, the lateral margins recurved anteriorly, humeral angles rounded, the postero-lateral sides sinuated, posterior side straight; mesosternal groove with a raised line in the middle. Scutellum long, narrow, at least two-thirds the length of the abdomen; legs with long, slender hairs, exterior face of the anterior tibiæ flat between the slightly elevated carinæ, basal tarsal joint longer and stouter than the apical one, the middle one narrow, less than half the length of the basal one. Corium produced at the exterior tip, membrane with seven nervures, the four exterior ones proceeding at base from a large cell. Connexivum thin exteriorly, broader than the hemelytra.

1. L. saucia.

Pentatoma saucia Say, Heteropt., 6, 12. Uhler, Proc. Bost. Soc. N. H., 1871, p. 97.

No. 47, Harris' Collection, ♀. "Sept 1, 1827."

Determined by Mr. Say.

2. L. senilis.

Pentatoma senilis Say, Heteropt., 5, 8. *Pentatoma grisea* Dallas, Brit. Mus. Cat., p. 246, 33.

No. 38, Harris' Collection, ♂, ♀. "June 30, 1826. May 10, 1835." Mr. Wilcox? N. Y., printed number 253.

Determined by Mr. Say.

ATOMOSIRA Uhler.

Oval, the sides subparallel, not dilated posteriorly. Head short, rounded in front, the sides sinuated in front of the eyes, face convex, the tylus forming the apex; eyes large, sub-truncated behind; antennæ longer than the head and thorax together, basal joint short, not nearly reaching the apex of the head, second joint shorter than the third, fourth and fifth much longer and stouter, fifth longest; rostrum reaching to or beyond the first ventral segment, second joint compressed, third depressed towards the tip, bucculæ slender, waved, not reaching the base of the head. Thorax hexagonal, convex, transverse, the lateral margins smooth, thickened, almost straight; posterior side concavely arcuated; mesosternum with a slight longitudinal carina, which becomes enlarged and produced on its anterior end. Scutellum long, the sides rounded, suddenly narrowed before the tip. Corium curved on the posterior edge, the exterior angle slightly produced; membrane with seven or eight longitudinal nervures which spring from a transverse curved one. Venter convex, smooth on the middle, the basal spine rudimentary.

1. A. sordida.

Atomosira sordida Uhler, Proc. Bost. Soc. N. H., 1871, p. 98.

Brownish or greenish yellow, polished, punctured above with fuscous or black. Face finely, closely punctured, each side of the tylus and some spots near the eyes and occiput impunctured; basal and second joint of antennæ green, remaining joints reddish except at base, where they are greenish; rostrum green, paler at base, the apical joint piceous. Thorax coarsely, deeply punctured in transverse, wavy, interrupted lines, the lateral submargins impressed, more densely and finely punctured, the lateral margins and some spots behind the head and upon the anterior margin smooth, yellow; humeri rounded. Sides of the antepectus densely punctured near the anterior corners, the rest of the surface more coarsely, remotely punctured, medio- and postpectus each with a spot of dense black punctures upon the pleura. Legs green, the last tarsal joint above, and the apex of the nails piceous. Scutellum punctured in transverse, wavy, interrupted series, the punctures finer towards the tip; tip impunctured, yellow. Corium guttated with distinct, deep punctures, which are more crowded near the base, the suture separating the exterior field of the corium piceous, and terminating upon the disk in an ill-defined spot of the same color; membrane brownish, transparent, the nervures darker. Connexivum yellow, finely punctured, having a double black spot at the incisures of the segments, both above and below; venter remotely punctured with brown, the punctures more dense on the sides and near the base, each side with two longitudinal series of double, black spots. Length, 10 mm. Humeral breadth, 5½ mm.

No. 71, Harris' Collection. "August 30, 1828. *Pentatoma dimidiata* Say. MSS."

It has been found in Mass., Maryland and Virginia. Mr. Say determined it as his *Pentatoma dimidiata*, but his description represents a species having the second joint of the antennæ one-half as long as the third. In our species the second joint is decidedly more than one-half the length of the third. It differs also in most of the other characters given by Mr. Say.

2. A. calva.

Pentatoma calva Say, Heteropt., 7, 13. *Rhaphigaster catinus* Dallas, Brit. Mus. Cat. Hemipt., I, 282, 25.

No. 54, Harris' Collection. "Dublin, N. H., Mr. Leonard. Maine, 1836, Mr. Randall."

Dr. Harris calls this *Pentatoma viridicolle*, but no such species occurs in his published papers.

The shape of the head is more quadrate than in the preceding species, but in generic characters the two agree very well.

NEZARA Amyot et Serv.

N. hilaris.

Pentatoma hilaris Say, Insects of La., 9; Heteropt. New Harm., 5, 9. *Nazara sarpinus* Dallas, Brit. Mus. Cat. Hemipt., I, 276, 4.

No. 1, Harris' Collection, ♂, ♀. "On *Tilia americana,* Dec. 1, 1825."

Determined by Mr. Say as his *P. hilaris.* Other synonyms will probably be hereafter added to this species. It is found in the West Indies, and extends as far south as Para, Brazil. Specimens have been sent to me from Canada, Maine, Massachusetts, New York, New Jersey, Pennsylvania, Maryland, Florida, Louisiana, Texas, Panama, Cuba, Hayti, and the above-named locality. Another specimen with the printed number 249, "Wilcox ? N. Y.," is in the collection.

RHAPHIGASTER Amyot et Serv.

R. pennsylvanicus.

Cimex viridis pennsylvanicus De Geer, Mémoires, III, 330, pl. 34, fig. 5. *Pentatoma abrupta* Say, Heteropt., 6, 10.

No. 129, Harris' Collection. "Cambridge, Mass., Mr. Randall."

Through the courtesy of Dr. Stål, of Stockholm, Sweden, I have been able to recognize this species of De Geer, which has hitherto remained unknown to our entomologists. Say's specimen came from Georgia, but I have a poor specimen from Panama, and I have examined others from New Jersey, Mass., and Illinois. The decidedly rounded outline and bluntly rounded humeri well agree with De Geer's figure, while the preceding species, to which it has been referred, is much more angular, particularly on the humeri.

THYANTA Stål.

T. custator.

Cimex custator Fab., Syst. Rhyng., 164, No. 43. *Pentatoma custator* H.-Schf., Wanz. Ins., VII, 96 and 106, fig. 771. *Pentatoma calceolata* Say, Heteropt., 8, 19.

No. 117, Harris' Collection, ♂. "Cambridge, Mass., Mr. Randall."

The specimen in this collection is so soiled, that if so during the lifetime of Dr. Harris he could hardly have been able to recognize in it either the species of Fabricius or that of Say.

ACANTHOSOMA Curtis.

A. laterale.

Edessa lateralis Say, Heteropt., 3, 2. *Acanthosoma nebulosa* Kirby, Fauna Bor. Amer., 277, 1. *Acathosoma nebulosum* Dallas, Brit. Mus. Cat. Hemipt., I, 307, 12.

In the collection, but without a number. It is widely distributed in Canada, British America and the northern states. "New Hampshire, August, 1850."

MICTINA.

EUTHOCTHA Mayr.

E. galeator.

Coreus galeator Fab., Syst. Rhyng., 191, 2. *Crinocerus tibialis* H.-Schf., Wanz. Ins., VI, 21, fig. 576. *Crinocerus galeator* Dallas, Brit. Mus. Cat. Hemipt., II, 408, 4. *Euthoctha galeator* Mayr, Novara Reise, Hemipt., 87. *Euthoctha galeator* Stål, Hem. Fab., I, 49.

No. 7, Harris' Collection, ♂, ♀. "On blackberry bushes, May 15, 1821–26; August 5, 1832; Sept. 30, 1837."

A specimen without designation of locality is in the collection.

ACANTHOCEPHALINA.

METAPODIUS Westw.

1. M. femoratus.

Cimex femoratus Fab., Syst. Entom., 708; *Lygæus femoratus*, Syst. Rhyng., 205, 10. *Rhynuchus nasulus* Say, Insects of La., 10. *Anisoscelis nasulus* Say, Heteropt., 13, 5. *Metapodius femoratus* Dallas, Brit Mus. Cat. Hemipt., II, 430, 5. *Metapodius obscurus* Hope, Cat. Hemipt., pt. II, 15.

Harris' Collection, without a number.

Three males and one female, from "Florida; Edward Doubleday."

2. M. instabilis.

Metapodius instabilis Uhler, Proc. Bost. Soc. N. H., 1871, p. 98.

Blackish-fuscous, sparingly clothed with yellowish pubescence, much more slender than *M. femoratus* Fab., and with the posterior femora much more slender, and almost not curved. Antennæ fuscous, the apical joint fulvous and much longer than either of the others, the basal and second joint about equal in length; rostrum reaching the tip of the intermediate coxæ, hairy and more or less tinged with yellow. Thorax a little broader than long; humeri prominent, bluntly subacuminate, having a slightly backward curvature; surface finely remotely punctured, and with scattered small tubercles, some of which are excavated, lateral margins deeply sinuated, the subcarinated edge bearing a few short, oblique, rather remote teeth, margins behind the humeri granulated: scutellum transversely wrinkled, the extreme tip yellow; hemelytra minutely, closely punctured, the punctures becoming a little coarser upon the clavus, the costal area, near the base, bearing a few minute granules; anterior pleura shining, granulated and punctured; odoriferous glands fulvous; legs blackish-piceous, the tarsi and ends of the tibiæ fulvous, nails piceous; posterior femora almost straight, the teeth graduating in size towards the tip, the five in a row nearest the tip large and curved; posterior tibiæ dilated exteriorly for two-thirds their length from near the base, sinuated upon the middle, the base of the sinus almost acutely angulated, the opposite end tapering, and beyond this a few very small, remote teeth, inner dilation very feeble, extending to about the middle, beyond this to the tip minutely tuberculato-denticulate, upper and lower surface of the dilatation granulated. Length, 19 millims. Humeral breadth, 7 millims.

No. 50, Harris' Collection, ♂. "*Anisoscelis prominulus* Say, MSS. So named by Mr. Say. Pennsylvania, Dr. Pickering; North Carolina, Prof. Hentz."

The typical specimen is the one from North Carolina. The other is probably destroyed, as it is not now in Dr. Harris' collection.

3. M. confraternus.

M. confraternus Uhler, Proc. Bost. Soc. N. H., 1871, p. 90.

Dark-brown, blackish-fuscous beneath; clothed, even upon the legs, with yellowish, almost prostrate hairs. Form and general appearance of the preceding species, but very distinct by the long and very robust posterior femora. Antennæ very long, slender, fuscous, the apical joint fulvous, longer than the basal one. Thorax very minutely punctured, remotely tuberculated, some of the tubercles excavated, humeral angles a little upturned, bluntly subacuminate; lateral margin subcarinate, with small, rather remote tubercular teeth, the sides subsinuated, anterior pleura polished, granulated, anteriorly with a few coarse punctures; odoriferous glands yellow; scutellum a little elevated on the disk, each side with a shallow impression, surface obsoletely transversely wrinkled, the extreme tip yellow; hemelytra densely, finely punctured, minutely granulated at base and on the costal area; legs blackish-piceous, anterior and intermediate tibiæ almost from base, tips of posterior tibiæ, and all the tarsi, fulvous; posterior femora heavy, clavate, longer than in *M. femoratus* Fab., the row of five teeth nearest the tip large and stout, the tibiæ moderately dilated exteriorly almost to the tip, tapering, the sinuosity shallow, the angle at its base not very prominent, interior dilation very narrow, sublinear, but slightly apparent, from the middle of this to the tip of the tibiæ minutely denticulate; three or four minute teeth on the opposite side of the tibiæ. Length, 23 millims. Humeral breadth, 8 millims. ♂.

Inhabits "Florida. Mr. Doubleday."

In Dr. Harris' Collection without a number. Both of these species may have been previously described, but the diagnoses given by Hope and Fabricius are too meagre to enable me to recognize their species.

ANISOSCELIDINA.

Leptoglossus Guér.

1. L. corculus.

Anisoscelis corculis Say, Heteropt., 12, 1.

Harris' Collection (No. 137 printed). ♂. "New York."

Say's specimens were obtained in Florida. This is a very remarkable species, from the unusual breadth of the humeral rounding. It belongs to the group of species having the zigzag, white band on the disk of the corium.

2. L. oppositus.

Anisoscelis oppositus Say, Heteropt., 12, 3. *Anisoscelis tibialis* H.-Schf., Wanz. Ins., VII, 12. *Anisoscelis tibialis* Dallas, Brit. Mus. Cat., 453, 5.

No. 49, Harris' Collection, ♀. "Philadelphia, Dr. Pickering."

Determined by Mr. Say.

3. L. phyllopus.

Cimex phyllopus Linn., Syst. Nat., Ed. 12, I, 731, No. 113. *Anisoscelis albicinctus* Say, Heteropt., 12, 2. *Anisoscelis confusa* Dallas, Brit. Mus. Cat., 453, 4.

No. 125, Harris' Collection, ♂, ♀. "Long Island, Mr. Gibbs; Florida, Edw. Doubleday."

ALYDINA.

Megalotomus Fieb.

M. 5-spinosus.

Lygæus 5-spinosus Say, Journ. Acad. Phila., IV, 323, 4. *Alydus* *cruentus* H.-Schf., Wanz. Ins., VIII, 100, tab. 282, fig. 868. *A. cruentus* Dallas, Brit. Mus. Cat., 477, 26.

No. 91, Harris' Collection, ♀. "Pennsylvania, Dr. Pickering." Determined by Mr. Say.

ALYDUS Am. et Serv.

1. A. eurinus.

Lygæus eurinus Say, Journ. Acad. Phila., IV, 324, 5.

No. 36, Harris' Collection, ♂, ♀. "Cambridge, Mass., June 30, 1826; Aug. 5, 1831; Sept. 1827; Oct. 10, 1837; Dublin, N. H., July 22, 1836; Hallowell, Me., Mr. Randall, frequent, July, Aug.; North Conway, N. H., Aug. 15, 1851; Ohio." And another specimen with a printed label No. 228.

This species is very closely related to *A. calcaratus* Fab., but upon comparison of a large number of specimens with some from Europe, I cannot believe it to be that species. Specimens from many parts of the United States agree pretty well in colors with *A. calcaratus*, but their form is proportionally much more slender, the pronotum more convex, and the abdomen more obese, with the basal constriction deeper.

2. A. pilosulus.

Alydus pilosulus H.-Schf., Wanz. Ins., VIII, 101, tab. 283, fig. 880. *Alydus pilosulus* Dallas, Brit. Mus. Cat., 478, 28.

No. 11, Harris' Collection, ♀. "Massachusetts."

This is the *Alydus vittinosus* Say of Dr. Harris' Catalogue; so determined by Say himself.

BERYTINA.

NEIDES Lat.

N. muticus.

Berytus muticus Say, Heteropt. New Harmony, 13. *Neidus decurvatus* Uhler, Hayden Surv. of Montana, 402; Proc. Bost. Soc. N. H., 1871, p. 100.

No. 72, Harris' Collection. "Dublin, N. H., Mr. Leonard."

This is the Canadian representative of the common *N. spinosus* Say. It belongs to the northern mountains, and to the high lands of Colorado, Dakota, Washington Territory, and western North Carolina. The specimen was determined by Mr. Say.

COREINA.

Anasa Amyot et Serv.

A. tristis.

Cimex tristis De Geer, Mémoires, III, 340, pl. 34, fig. 20. *Coreus rugator* Fab., Syst. Rhyng., 192, 4. *Oriterus destructor* Hahn, Wanz. Ins., I, 8, tab. 1, fig. 2. *Coreus ordinatus Say*, Journ. Acad. Phila., IV, 318, 2. *Gonocerus rugator* Burm., Handb., II, 311, 4. *Anasa tristis* Stål, Ent. Zeitsch., Stettin, XXIII, 301, 172.

No. 4, Harris' Collection, ♂, ♀. "On squash vines; Aug. 1–20. Larva and pupa, abundant. Florence, Alabama, Jan. and Feb., 1836, Prof. N. M. Hentz; Connecticut."

Determined as *Coreus ordinatus* by Mr. Say.

This is the ordinary squash bug, so well known to farmers and gardeners. It is now found over the whole length and breadth of the United States, extending into Mexico, the West India Islands, Central America and Brazil. In California and Arizona it sustains the greatest amount of variation and reaches its largest size. It is the most persistent pest of the melon and squash grower, swarming both upon the fruit and the vines, sucking their juices, and causing them to shrivel and die.

CHARIESTERINA.

Chariesterus Lap.

C. antennator.

Coreus antennator Fab., Syst. Rhyng., 198, 33. *Chariesterus mœstus* H.-Schf., Wanz. Ins., VII, 3, tab. 217, fig. 681. *Gonocerus dubius* Say, Heteropt., 10.

No. 90, Harris' Collection, ♂. "Pennsylvania, Dr. Pickering."

Mr. Say was induced to redescribe this species because of the uncertainty produced by the Fabrician description, which reads —"*Antennæ . . . articulo secundo scabro,* tertio apice dilatato, *membranaceo, atro, ultimo claviformi.*" The manner in which the antennæ are attached to the front of the head causes the lateral produced lobes to appear like basal joints. Hence, Fabricius describes the second joint to be scabrous, instead of the basal one. The apical, or ultimate, joint would appear distinctly club-shaped but for the dilatation of the apex of the third. The species is rather common in the Middle and Southern States. The specimen was determined by Mr. Say.

RHOPALINA.

Corizus Fallen.

C. lateralis.

Coreus lateralis Say, Journ. Acad. Phila., IV, 320, 4.

Nos. 102 and 119, Harris' Collection, ♂, two specimens. "N. H., Mr. Leonard; Cambridge, Mass., Aug. 15, 1832."

Determined by Mr. Say.

Dr. Signoret, Ann. Soc. Ent. de France, 1858, 3e sér., VII, 97, No. 36, describes a *Corizus* which he refers to *C. lateralis* Say; but some of the characters there employed do not agree with those given by Mr. Say, and therefore I hesitate to quote the references here. Dr. Harris received most of his names direct from Mr. Say, and they should not be set aside without ample verification.

LYGÆIDAE.

Lygænia.

Lygæus Am. et Serv.

1. L. turcicus.

Lygæus turcicus Fab., Syst. Rhyng., 218, 61. *Ib.*, H.-Schf., Wanz. Ins., IX, 195.

No. 21, Harris' Collection. "On *Asclepias syriaca*, July 10, 1822. Larvæ on Asclepias, Oct. 15, 1832. North Cannon, Mich., T. E. Wetmore." Westfield, Mass., Dr. S. Shurtleff.

2. L. reclivatus.

Lygæus reclivatus Say, Journ. Acad. Phila., IV, 321, 1. *Lygæus bipunctulus* H.-Schf., Wanz. Ins., IX, 195.

"Columbia River," Washington Territory.

In Harris' Collection, without a regular number.

Erythrischius Stål.

E. fasciatus.

Lygæus aulicus H.-Schf. (nec. Linn.), Wanz. Ins., VI, 76, fig. 646. *Lggæus fasciatus* Dallas, Brit. Mus. List Hemipt., II, 538, 17. *Erythrischius fasciatus* Stål, Enum. Hemipt., IV, 103, 14.

No. 86, Harris' Collection. "North Carolina, Mr. Hentz, July; Pennsylvania, Dr. Pickering; Louisiana, Mr. Eustis."

Another specimen, with printed label No. 522, is a male of the variety with orange hemelytra. The species is common all over the eastern side of the North American continent, from Maine to Florida, and thence through the West Indies, Mexico, and Central America to Brazil.

MYODOCHINA.

Ptochiomera Say.

P. nodosa.

Ptochiomera nodosus Say, Heteropt. New Harmony, 18, 9. *Aphanus clavatus* Dallas, Brit. Mus. Cat. Hemipt., 590, 5.

No. 144, Harris' Collection. "Alabama, February, Prof. Hentz, and North Carolina."

M.M. Amyot and Serville, in their "Histoire naturelle des Insectes: Hémiptères" have employed the term Plociomerus, placing Say's name after it, for a genus represented by the European *Pachymerus fracticollis* Schill. This is in no sense equivalent to the genus Ptochiomera of Say, and should not be confused with it because of similarity of spelling. More recently Dr. Stål has used the name Ligyrocoris in its stead, and referred to it two of our common species described by Say in his genus Pamera. However, as the latter author has failed to characterize that genus, it cannot stand; and the species included in it will be distributed to the different genera in which they belong.

In 1861 Dr. Fieber, in his "Europäischen Hemiptera," employed the name Plociomerus for four European species, including the *P. fraticollis* Schill., and our *Ligyrocoris silvestris* Linn.; hence if the genus of M.M. Amyot and Serville must be set aside, that of Dr. Stål must be substituted for it.

The *Ptochiomera nodosa* is quite common beneath stones, etc., in fields and meadows in early spring, and like *Micropus falicus* and *Blissus leucopterus* often has the hemelytra and wings short or undeveloped.

Cnemodus H.-Schf.

C. mavortius.

Astemma mavortia Say, Heteropt. New Harmony, 10. *Cnemodus brevipennis* H.-Schf., Wanz. Ins., IX, 184, pl. 309, fig. 948.

No. 118, Harris' Collection. "♂, Cambridge, Randall."

Determined by Mr. Say.

Extremely common in sheltered places beneath stones, fallen leave and rubbish. It varies much in the breadth of its outline, and has the hemelytra and wings of at least three dimensions. Most commonly in the vicinity of Baltimore the hemelytra are shorter than the abdomen.

Myodocha Latr.

M. serripes.

Myodocha serripes Oliv., Encyc. Method., VIII, 106. *Myodocha petiolata* Say, Heteropt. New Harmony, 19. *Myodocha opetiolata* Fitch (by misprint), N. Y. State Agricult. Soc. Trans., XVII, 781. *Chiroleptes raptor* Kirby, Fauna Bor. Amer., IV, 281. *Myodocha serripes* H.-Schf., Wanz. Ins., IX, fig. 966.

No. 27, Harris' Collection. "Under boards, Dec. 1, 1830 March 25, 1828. Dr. Pickering, Philadelphia; and North Carolina, Prof. Hentz."

Determined as *M. petiolata* by Mr. Say.

This is an extremely common species, often found in company with the preceding. Occasionally common in stubble fields after the wheat and oats have been reaped and removed; sometimes, also, in the straw stored in the barns. It may be found hibernating in winter beneath stones, logs, and leaves, or in stumps of trees behind the loose bark.

Ligyrocoris Stål.

1. L. sylvestris.

Cimex sylvestris Linn., Fauna Suec., 256. *Plociomerus silvestris* Fieb., Eur. Hemipt., 171. *Plociomerus diffusus* Uhler, Proc. Boston Soc. Nat. Hist., 1871, p. 101; Extra, 9. *Pamera contracta* Say, Heteropt., 16.

No. 103, Harris' Collection. "New Hampshire, Mr. Leonard."

Dr. Harris (upon Mr. Say's own determination) refers this species to *Pamera bilobata* Say. It does not, however, agree with the description of that insect, and upon comparison with specimens is seen to be widely different from it. The *P. bilobata* is an inhabitant of the Southern States, being quite common in Florida, South Carolina and Louisiana. Its most northern limit thus far observed is in the Carolinian district of Maryland.

2. L. constrictus.

Pamera constricta Say, Heteropt., 15, No. 1. *Beosus abdominalis* Guér., Sagra, Hist. Nat. de Cuba, Ins., 397. *Plociomera piligera* Stål, Stettin. Ent. Zeitschr., XVIII, 312.

No. 122, Harris' Collection. "Milton, Aug. 15, 1831."

Determined as *Pamera constricta* by Mr. Say.

This species is moderately common in Eastern Massachusetts, and extends as far south as Mexico and Central America. It seems to be abundant in Cuba, and occasional in the other large islands of the Antilles.

In colors and proportions, as well as in amount of pilosity, it is quite variable, and but for the links between the extremes, might readily be arranged in about three species. The males are sometimes very slender, causing them to appear abnormally long-legged; while the females are occasionally very obese, dark and dull, especially when distended with eggs. They live in the rubbish of fields and gardens, especially among tangled grasses and plants, in late summer.

Ozophora Uhler.

Elongate-oval, sides subparallel. Head small, sinuated before the eyes, the diameter through the eyes greater than the anterior width of the pronotum; tylus convex, bluntly curved; cranium bald at base, and on each side of the vertex, the remainder and the face pubescent; surface behind the eyes tumid; the eyes situated on the sides a little below the plane of the vertex, deeply seated, and not close to the pronotum. Antennæ long, slender, minutely pubescent; basal joint more than half as long as the head, stouter than the apical one; second almost as long as the basal and third conjoined; fourth a little curved, as stout as the thickened tip of the third. Rostrum reaching behind the posterior coxæ, the basal joint as long as the head. Thorax trapezoidal, sinuated on the sides, the lateral margins narrowly reflexed from the humeri to near the collum, the reflexed line thick and undulated; anterior lobe of the pronotum moderately convex, a little more than half as long as the posterior lobe, the anterior margin with a narrow, raised collum; posterior lobe wider than the length of the two lobes conjoined, the posterior margin concave, and the lateral margins sinuated; the humeri much elevated, smooth, tubercle-like; pleura with a crescentic, smooth, elevated longitudinal lobe, placed just below the lateral carina of the pronotum. Legs long, the anterior femora thick, abruptly narrowed at base, with a few very slender remote spines between the middle and the tip, posterior femora very long and slender. Scutellum short, acute. Membrane with five curved nervures, the two inner ones parallel to each other, the extreme outer one very short and almost straight.

Similar in form to the preceding genus, but differing at first sight by the carinate reflexed margin of pronotum, etc.

O. picturata.

Ozophora picturata Uhler, Proc. Bost. Soc. N. H., 1871, p. 102.

Pale rufo-piceous, or dull rufo-testaceous, elongate-oval, colors beneath and upon the anterior lobe of pronotum opaque; hemelytra and base of pronotum glossy. Antennæ, rostrum, legs, hemelytra, posterior lobe of pronotum, and scutellum, testaceous. Apex of the second and third joints, and apical two-thirds of the last joint of the antennæ, blackish, the basal third of the latter white. Head finely punctured beneath, and more densely so upon the middle line, front, and near the eyes; tips of the lateral lobes, and of the tylus, honey-yellow, tip of rostrum piceous. Anterior lobe of pronotum impunctured, more or less dark brown, the raised collar yellow, with a few brown spots; lateral elevated margins more or less yellow, or pale piceous; posterior lobe coarsely, irregularly, remotely punctured with brown, and with brown longitudinal stripes (usually five), of which the middle one is divided longitudinally by a smooth yellow line; humeri smooth, yellow, generally with a dark brown spot exteriorly. Pectoral areas with fine, remote, shallow punctures; posterior and upper edges of the metasthetium yellow, coxæ and the surface at their base pale piceous, or yellow. Scutellum remotely punctured, having a V-shaped, smooth, yellow line (with its apex pointing towards the apex of the scutellum), the lateral edges and tip, also, yellow. Hemelytra punctured with brown in oblique lines, the clavus clouded with brown; corium with a small streak near the base, a broad spot behind the middle, which reaches the exterior edge in a small (usually detached) spot, a spot at the apical exterior corner, which continues along the suture of the membrane to the inner angle, fuscous; costal margin broadly white, impunctured; membrane fuscous, a few irregular figures near the base, the nervures, and a large spot at the tip, white. Venter impunctured, clothed with fine yellowish pubescence. Length a trifle more or less than 6 millims. Humeral breadth, 1.5 millims.

No. 127, Harris' Collection, ♀. "Cambridge, Mass., April 9, 1835."

Beosus Burmeisteri Guer., belongs to this genus, and is so closely allied to this species that a long series of specimens may prove them to be identical. I have examined only females. A careful study of the male will, probably, render it necessary to add to the generic characters employed above.

EREMOCORIS Fieber.

E. ferus.

Pamera fera Say, Hemipt., 16, 4. *Eremocoris ferus* Uhler, Proc. Bost. Soc. N. H., 1871, p. 103. *Rhyparochromus borealis* Dallas, Brit. Mus. Cat., 565, 16.

No. 73, Harris' Collection, ♂, ♀.

The No. 73 of Dr. Harris' MS. Catalogue is called *Anisoscelis prominulus* Say, MSS. Both Dr. Harris and Mr. Say well knew the genus Anisoscelis; so there must have been originally a very different insect from the present with that number attached to the pin. I, accordingly, omit the dates of capture given in the Catalogue, as I am not sure that they refer to the present species.

PERITRECHUS Fieber.

P. fraternus.

Peritrechus fraternus Uhler, Proc. Bost. Soc. N.H., 1871, p. 103.

Elongate-ovate, very slightly convex, black, above dull; without long pile. Head black, a little polished, with fine, remote punctures above and beneath, face with fine pubescence, which is erect and longer about the tip of the tylus. Antennæ pitchy-black, clothed with short, erect pile, the scapus and incisures of the joints pale piceous. Tip of tylus and rostrum pale piceous, or honey-yellow, the rostrum (♀) reaching beyond the mesosternum, its tip darker piceous. Thorax broad, very slightly convex, the impression dividing the anterior from the posterior lobe very indistinct, but a little better defined each side, the lateral reflexed margin decurved correspondingly with the anterior angles so as to meet the middle line of the eye; surface dull, having a few minute, remote, prostrate hairs; the anterior lobe black, the collar pale piceous, the posterior lobe dull ochreous-yellow, with remote, coarse, blackish punctures; the posterior margin smooth, impunctured; humeri moderately elevated, the tubercle long, with a dusky spot in front. Pectus dull black, the pleural pieces having a few remote, obsolete punctures. Legs, pale rufo-piceous, the anterior femora blackish-piceous, excepting the knees; tibiæ dusky above, becoming paler towards the tip, the tarsi also pale, but more or less dusky above and at tip, intermediate and posterior femora dark piceous upon the middle, the trochanters, coxæ and surface adjacent pale rufo-piceous. Scutellum long, convex, dull black, the raised edge, tip and submargins near the tip pale ochreous-yellow, the surface before the tip remotely punctured, and with a shallow depression upon the middle. Hemelytra pale, dull ochreous-yellow, punctured obliquely, in numerous rows, with black; a few dusky spots and clouds, caused by aggregations of punctures, near the interior edge of the clavus and upon the disk and posterior portion of the corium, the corium having the costal margin, and two or more small spots on the disk, smooth, yellow. Membrane whitish, with a spot not far from the interior angle and a few less distinct ones upon the middle and sides, brown; the milk-white spot of the interior angle not very distinct. Venter black, shining, very minutely, closely punctured, covered with minute, yellowish pubescence. Costal submargin at tip with a black spot. Length, 5 millims.; humeral breadth, 1.75 millims. ♂.

No. 146, Harris' Collection. "Cambridge, Mass., April 20, 1837, under a board."

GONIANOTUS Fieber.

G. marginepunctatus.

Lygæus marginepunctatus Wolff, Ic. Cim., 150, tab. xv, fig. 144. *Pachymerus marginepunctatus* Hahn, Wanz. Ins., I, fig. 32. *Gonianotus marginepunctatus* Fieber, Eur. Hemipt., 197, 1.

No. 128, Harris' Collection. "Cambridge, Mass., May 1, 1835."

This species is probably an importation from Europe, as it offers no difference from specimens which I have examined from Germany. Several of the varieties found in Europe are, also, to be met with in this country.

BLISSINA.

BLISSUS Burm.

B. leucopterus.

Lygæus leucopterus Say, Hemipt. New Harm., 14, 5. *Micropus leucopterus* Fitch, Country Gent., v, 396; Trans. N. Y. State Agricult. Soc., XIV, 293. *Micropus leucopterus* Signoret, Ann. Soc. France, 3d ser., v, 31, No. 11, pl. 2, fig. 11.

Harris' Collection, without a number. "Nov. 1, 1844. Cambridge, June 17, 1853, garden. Illinois, Sept. 16, 1850, living." "In meadows under stones and sticks; in swarms."

All but one of the specimens from Massachusetts are of the short-winged form. Those from Illinois have the hemelytra and wings fully developed.

GEOCORINA.

GEOCORIS Fallen.

1. G. piceus.

Salda picea Say, Hemipt. New Harm., 18, 1.

No. 10, Harris' Collection, ♂, ♀. "Under boards. Dec. 10, 1830. May 18, 1829. March, 1831. April 3 and 27, 1831. May 10, 1831."

Dr. Harris, in the MS. Catalogue, calls this *Salda pedunculata* Say, but I do not find any such name among Say's descriptions.

2. G. bullatus.

Salda bullata Say, Hemipt., 18, 2.

No. 104, Harris' Collection, ♂, ♀. "New Hampshire, Mr. Leonard. 104 ? Florence, Alab., Mr. Hentz, Jan. or Feb., 1836."

Determined by Mr. Say.

This species varies greatly. The large specimen from Alabama agrees, except in size, with specimens from other parts of the Union.

NYSIINA.

BELONOCHILUS Uhler.

Elongate-oval, flattened above, thorax and head forming a long triangle; abdomen elongate-elliptical, sides parallel. Head very long, acutely narrowed to the tip, gently cylindrico-convex above, slightly slanting; tylus long, reaching to about the anterior line of the eyes, a little narrowed at base, the tip scarcely projecting beyond the labrum; superior lobe of cheeks triangular, emarginated above, acuminate at tip, the inferior lobe longer, elongated, rounded at tip and coalescing with the bucculæ, convexly raised on the middle line, not quite extending to the tip of the tylus, bucculæ linear, thin, expanded at tip; rostrum long and slender, reaching to the tip of the sixth segment, first joint as long as the head, enclosed at base by the bucculæ, a little stouter than the second, the second a little longer than the first, third about twice the length of the fourth, fourth a little shorter than the first, the two latter very slender, a little more so than the second joint; antennæ about as long as the head, pronotum, and scutellum united, the basal joint obconical, constricted at base, inserted about half way between the eye and tip of tylus, its length being less than that from the eye to the end of the scapus, much thicker than the succeeding joints, and about equal in thickness to the apical one; second joint longest, slender, almost as long as the pronotum, enlarged at tip, third of the same thickness as the second and about two-thirds as long, also enlarged at tip, fourth thick, scarcely shorter than the third, conical at base and tip; buccal gutter extending to the base of the gula. Pronotum short-sub-campanuliform, moderately declining forwards, surface almost flat, sides sinuated, carinately elevated, posterior margin arcuated to receive the head, posterior margin subtruncated, emarginated each side adjoining the humeri, humeral angles prominently raised; pro- meso- and metasternum deeply grooved, the groove also defined on the basal, second and third ventral segments. Scutellum short, broad, transversely elevated at base, from this a medial, raised, blunt carina runs backward to the tip; clavus very little broader on a line with the tip of the scutellum than at base; corium truncated on its interior end, as far as to the median nervure, exterior to this it is triangularly prolonged, becoming connate with the cuneus, which is moderately bent on its interior margin; membrane with two closed areoles at base interiorly, from each of these a nervule runs back to the tip, and besides these, nearer the exterior margin, radiate three nervules, the two inner ones running to the tip, the outer one curving to the exterior margin. Abdomen flattened above, the connexivum thin, blade-like, much elevated, ventral segments of the female much flattened, strongly overlapping and carried very obliquely backward, in curved wedges, to the second segment.

B. numenius.

Lygæus numenius Say, Hemipt. New Harm., 15, No. 9. *Belonochilus numerius* Uhler, Proc. Bost. Soc. N. H., 1871, p. 104.

No. 81, Harris' Collection, ♀. "Sept. 1, 1829. Pennsylvania, Dr. Pickering."

This is an extremely rare species in Maryland; but I have examined several specimens from Ohio and Illinois. It was determined for Dr. Harris by Mr. Say.

ISCHNORHYNCHUS Fieber.

I. resedæ Stål.

Lygæus resedæ Panzer, Faun. Germ., 40, 20. *Lygæus didymus* Zett., Acta Holm., 71 (1819). *Lygæus geminatus* Say, Hemipt. New Harm., 14, 7.

No. 41, Harris' Collection. "April 20, 1822; May 20, 1831, and New Hampshire, Mr. Leonard. Wier's, Aug. 16, 1851."

Determined as *Lygæus geminatus* by Mr. Say.

This species is quite common both in the Eastern and Western sections of the United States, and is found as far north as Lake Winnipeg. One specimen without a number.

Nysius Dallas.

N. thymi.

Nysius thymi Wolff, Icones Cim., fig. 143.

No. 123, Harris' Collection. "Cambridge, Mass., Sept. 25, 1832." "*Coreus catenarius* Say, MSS."

Specimens of this insect, collected in Walrussia, at the extreme northern part of the Mackenzie River region, in Canada, and in most of the States east of the Mississippi basin, as well as in New England, have been sent to me for examination. Its introduction from the Eastern continent to this, or the converse, may have been across Behring's Strait, as it is found in Siberia and Kamtschatka. Dr. Stål has examined specimens from Sitka. Mr. Robert Kennicott secured specimens in British and Russian America, which are now the property of the Smithsonian Institution. During some summers it has been very abundant near Baltimore upon various plants and bushes around the édges of fields and meadows.

Cymus Hahn.

C. clavulus.

Cymus claviculus Hahn, Wanz. Ins., I, 77, tab. 12, fig. 44.

No. 79, Harris' Collection, ♀. "April 20, 1822."

"*Coreus striatipennis* Say, MS."

Evidently introduced from Europe. It is now common in New England, New York, Pennsylvania, New Jersey and Maryland.

No. 142, from "Alabama, Prof. Hentz, February," is a neat little Pachymerid of new genus and species; but the specimen is too poor to bear description.

PHYTOCORIDÆ.

Miris Auctor.

M. instabilis.

Miris instabilis Uhler, Proc. Bost. Soc. N. H., 1871, p. 104.

Form and general appearance similar to *M. virens* Linn. Green, greenish-testaceous, or pale dull straw-yellow, clothed with close yellow pubescence. Head broad conical, having a blackish vitta each side, which is usually continued backward over the pronotum and scutellum to the apex of the corium; apex of the head a little upturned, the vertex densely pubescent, minutely confluently punctured, at base bald, impunctured and with a central impressed line. Antennæ robust, rufous, the basal joint a little longer than the head, sometimes greenish, armed with long stiff hairs. Eyes round, prominent, posteriorly in contact with the pronotum. Rostrum reaching to behind the middle coxæ. Pronotum convex behind, finely, deeply and in part confluently punctured, the lateral margins broadly sinuated, and the carinate edge sharply prominent; the anterior angle callous exteriorly, and destitute of the carinate edge. Humeral angles slightly recurved behind, the median line distinct, pale. Propleura coarsely and confluently punctured, having each side a slender brown or red line which is continued interruptedly along the venter; meso- and metapleura punctured on the middle. Hemelytra almost white on the costal margin and on the inner edge; the surface pubescent, minutely closely punctured; the cuneus usually pale green, and the membrane hyaline, or tinged with brown, with rufous or pale brown nervures, sometimes having a fuscous streak protracted beyond the nervure. Wings hyaline or faintly infuscated, iridescent, with the nervures brown. Scutellum more finely punctured than the pronotum, often having those of the middle and base fuscous, the middle line pale and smooth. Tergum green or pale rufous, with the disk more or less infuscated. Venter green or pale rufo-testaceous, invested with rather close set yellow sericeous pubescence. Legs pale green, pubescent, usually having the tarsi and apex of the tibiæ rufous; posterior femora commonly with two series of piceous or rufous dots above and two similar series below; the nails and part of joint next to them piceous. Length, 6–7½ millims. Breadth of pronotum, 1¾–2 millims.

No. 70, [u] Harris' Collection,[1] ♂. "New Hampshire, Mr. Leonard. Milton, July 20, 1828."

Dr. Harris refers this to *Miris bivittatus* Say, but as no published description of it has previously appeared, the above will serve to characterize it for the present. It seems strange that among the thousands of specimens of Miris which have been collected in regions whence Prof. Say obtained his, that not one has yet been reported which agrees with his short diagnosis of *Miris dorsalis.* Our species abounds in New England, New York, New Jersey, Pennsylvania, Delaware, Maryland, Michigan, Illinois, Wisconsin, Minnesota, North

[1] The letter "u" in the Harris catalogue means that the specimen is unique.

Carolina; and recently specimens have been brought from Colorado and Montana. The specimen belonging to No. 70 without the *u* was not in the collection when examined by me.

LOPOMORPHUS Doug. & Scott.

L. dolobratus.

Cimex dolobratus Linn., Syst. Nat., ed. 12, 730, No. 103. *Lopomorphus dolobratus* Doug. & Scott, Brit. Hemipt., 297, No. 5.

No. 120, Harris' Collection, ♂, ♀. "*Miris flagellatus* Say, MS. Cambridge. Determined by himself. Mr. Randall and myself, August 15, 1832. June 10, 1833. July 1, 1834. June 20, 1835."

This species, evidently introduced from Europe, has recently become fully established in localities where it did not exist a few years ago. In Maryland, on the edges of wheat fields, and in eastern Massachusetts on grassy low grounds, it appears in swarms. About ten years ago I first met with a few individuals near Baltimore, by sweeping the grass, etc., about the edge of a wheat field; since then they have greatly multiplied, and large numbers may now be obtained there and in similar localities elsewhere. In Cambridge, Mass., the grass is sometimes crowded with them. Specimens from Connecticut, kindly obtained for me by Mr. Edward Norton, have the antennæ yellow, and are a little more slender than usual. Both the short-winged and the fully-winged varieties occur in all the localities known to me.

NABIDEA Uhler.

General form of Nabis, elongated, body subcylindrical. Head long, subcylindrical, clavate in front including the eyes, behind the eyes elongated into a neck, which is almost as long as the face and front; face blunt and broad, the tylus vertical, forming with the upper lobes a globose prominence, the upper lobes almost as broad as the tylus, triangular at tip; inferior lobes much longer than the upper ones, narrowed and extending to the tip of the tylus, very slightly convex, bounded above by a deeply impressed line; tylus at base connate with the clypeus; cranium between the eyes with a short, deep, longitudinal groove, behind transversely impressed, behind this an elevated hump as in the Reduviina; gula moderately swollen beneath the eyes, the middle line slightly grooved; rostrum moderately curved, reaching to the posterior coxæ, the basal joint stout, compressed, extending to the anterior coxa, the apex superiorly produced over the base of the second joint, the other joints more slender, the second much compressed, a little longer than the first, third depressed, hardly half as long as the second, apical one longer than the preceding and shorter than the basal joint; antennæ setaceous, situated below the middle line of the eyes, much longer than the body, clothed with remote, obliquely-erect hairs, the basal joint cylindrical, slender, gradually enlarging to the tip, rather longer than the head, second joint much more slender, more than twice as long as the first, third still more slender, about two-thirds the length of the second, fourth slightly more slender, a little shorter than the third; eyes prominent, subhemispherical, a little higher than broad. Pronotum subcampanulate, a little broader at base than long, the anterior lobe almost cylindrical, about two-thirds the breadth of the posterior one, the callosities greatly elevated, convex, separated by a narrow incision, humeral angles slightly elevated, the posterior margin subtruncate and acutely raised. Legs long, slender, cylindrical, the posterior femora longer and stouter than the others, curved at base, the basal joint of the tarsi longer than the two others conjoined. Sides of the hemelytra subparallel, the costal margin a little broadened just behind its origin, cuneus long and broad, concavely arcuated at base and not acutely incised; membrane extending much beyond the abdomen in fully winged individuals, the basal cell longer than the cuneus, elongate, triangular at base, and narrowing from the middle to tip, where it is truncated.

N. coracina n. sp.

"*Miris coracinus* Say, MS."

No. 121, Harris' Collection, ♀. "New Hampshire, Mr. Leonard."

Determined by Mr. Say.

Black, shining. Head polished, impunctured, a transverse white spot behind the line of the eyes; eyes glaucous, or pale brown; antennæ fuscous or piceous, the basal joint luteous, black at base, scapus yellow; rostrum pale yellow, almost translucent, piceous at its origin, and also apical two-thirds of the last joint piceous. Pronotum black with a tinge of lead color, collum yellow, near each humeral angle is a large, round velvety-black spot, callosities large, high, round, polished, separated by a shallow line; posterior lobe remotely punctured, humeral angles sharp-edged, yellow, connected on the side with a very short carina; edges of the anterior coxal sockets, and posterior part of the metapleura, yellow; legs testaceous, the coxæ more or less infuscated, femora with rows of brown dots. Scutellum blackish, finely punctured from behind the base to the tip. Hemelytra pale dull testaceous, infuscated near the base on the inner side, as is also the clavus, particularly on the edge; corium with a fuscous spot near the apex, and also the interior edge until upon the membrane, membrane slightly embrowned. Abdomen black, shining, connexivum and basal edge superiorly of the genital segment yellow; ventral segments sometimes margined, and spotted on the middle, with yellow.

Resthenia Spin.

1. R. insitiva.

Capsus insitivus Say, Hemipt. New Harm., 21, 8.

No. 39; Harris' Collection. "July, 1826."

Determined by Mr. Say.

This is a southern form, more particularly abundant south of Maryland. The present is the only specimen that I know to have been obtained north of Pennsylvania. It is rare in this part of Maryland, but less so in the districts belonging to the Carolinian fauna.

2. R. confraterna, n. sp.

Bright sanguineous, opaque, form of *R. insitiva.* Eyes, antennæ, circle upon the cranium, tylus and labrum black; head across the eyes much broader than apex of the pronotum, eyes round above and prominent, front very convex and more elevated than in the preceding species; the antennæ not so stout, clothed with fine, erect hairs, the basal joint a little shorter than the anterior breadth of the pronotum; the second joint twice as long as the basal one and a little more slender, cylindrical, third joint still more slender, becoming gradually more so towards the tip, fourth decreasingly slender and about equal in length to the basal joint; anterior lobe of the genæ extending a little beyond the middle of the tylus, triangular, rather blunt at tip; inferior lobe not quite reaching the apex of the tylus, tipped with black; rostrum reaching the posterior coxæ, more or less piceous, the basal joint a little longer than the head, second joint a little shorter than the fourth, third a little shorter than the second, slightly swollen at base, fourth joint longest, stouter than the second or third. Prothorax orange or red, longer than broad, regularly convex on the disk, the collar broad, high, infuscated on the middle, the incised line deep and entire, running continuously to the anterior acetabulæ, callosities high, transverse, black, coalescing on the middle line; on the middle a large, subtriangular black spot, extending from the callosities to the basal margin; humeral angles bluntly rounded, the posterior margin regularly bowed, the edge turned downwards; lateral margins sinuated. Scutellum subequilateral, convexly elevated, opaque, black, impunctured. Hemelytra finely pubescent, opaque, impunctured, black, the costal margin slightly bowed, broadly bright red, as is also the base of the clavus, base of the cuneus not incised; membrane fuscous. Wings brown, the nervures darker. Legs fuscous or black, the middle or apical joints of the tarsi narrower than the basal one; coxæ yellowish, tinged with fuscous, or red, at base. Length, 10 millims. Humeral breadth, $2\frac{1}{2}$ millims.

No. 48, Harris' Collection. "Massachusetts, Sept. 15, 1827. Var. New Hampshire, Mr. Leonard. *Capsus trifidus* Say, MSS."

The variety alluded to is a race of *Capsus dislocatus* Say, and not of the Resthenia just described. A specimen in my collection obtained by myself in Maryland has the circle of the front of the head filled in with black, and the hemelytra are entirely black. The abdomen is blood red, with the genital region and sternum infuscated, and with the rostrum fuscous, excepting only the first joint on its upper side, where it is yellowish. In the fresh specimen the rostrum is remotely pubescent.

In Dr. Harris' specimen the eyes are black, the legs fuscous, a little paler on the underside of femora, the coxæ yellowish-white with a tinge of red, at base a little infuscated, the tarsi pale beneath; the posterior pair of legs are wanting, as is also the abdomen. The red margin of the hemelytra is as broad as the clavus, covering the whole of the cuneus except a very small part of the inner corner. The black spot on disk of pronotum is broad at base and gradually narrowing to the head, but dilated in a transverse streak across the callosities. This is the only specimen now present in his collection.

3. R. insignis.

Capsus insignis Say, Heteropt. New Harmony, 22, No. 12.

A specimen with old red label, No. 168, is in the collection.

Deræocoris Kirschb.

1. D. bipunctatus.

Lygæus bipunctatus Fab., Syst. Rhyng., 235, 158.

No. 58, Harris' Collection. "On grass in June."

I have collected many individuals of this species by sweeping the grass and herbage of the margins of elevated spots in the midst of the marshes near Chelsea, Mass. It is common in England and on the Continent, and was probably introduced into the United States from some part of Europe. Named *Capsus virens* ? F., by Mr. Say.

2. D. rapidus.

Capsus rapidus Say, Hem. New Harm., 20, 4. *Capsus melaxanthus* H.-Schf., Wanz. Ins., VIII, 18, tab. 254, fig. 794.

No. 45, Harris' Collection, ♂. "Pennsylvania, Dr. Pickering. Milton, June 20, 1827. Cambridge, Aug. 20, 1835. Maine, Randall. Mt. Auburn, Oct. 8, 1836."

Determined by Mr. Say.

This is a common species throughout the States east of the Mississippi river, and extends into Canada and British America. Two specimens, ♂, ♀, are now in this collection.

Coccobaphes Uhler.

Long-ovate, gradually expanding to beyond the middle of the hemelytra, pubescent, punctured. Head about as long as high, blunt, convex; face vertical, the crown a very little higher than the eyes, conjointly with the clypeus very convex, bounded on the sides and front by a line-like impression; eyes remote from the front, subpyriform, very convex, bisinuated behind; antennæ a little shorter than the body, basal joint shorter than the pronotum, second two and one-half times as long as the basal, the base and apex narrowed, third and fourth setaceous, together a little shorter than the second; tylus vertical, prominent, convex, not decurved at tip; rostrum reaching to the posterior coxæ, the basal joint longer than the head, broad, much dilated at tip; superior lobe triangular at tip, almost flat, inferior lobe longer, prominent, very convex, triangularly rounded at tip. Pronotum convex, one and one-half times as broad as long, the collar broad, flattened on the middle, the callosities transverse, coalescing in the middle line; lateral edge not carinate, almost straight; posterior margin broadly rounded, the humeral angles triangularly rounded. Scutellum elevated, almost equilateral, convex. Cuneus long, acutely narrowed to the tip; corium broadly rounded on the costal margin, slightly convex, broadest across the tip of the clavus; basal celluli of membrane large, long, the postero-interior angle rounded. Costal area of wings without a recurrent vein.

C. sanguinareus, n. sp.

Blood-red, shining, a little more opaque on the hemelytra, clothed with yellowish pubescence. Head smooth, brilliant, impunctured, rastrated about the cavity of the antennæ; tylus and eyes black (the latter sometimes red); antennæ black, stout, the two basal joints clothed with pubescence and long, oblique setæ, first joint red at base, the two apical joints yellow, very slender. Posterior attachment to the eyes red. Pronotum rather finely, deeply, confluently punctured, clothed with erect, yellowish pubescence, the callosities prominent, and together with the collum and anterior corners polished and impunctured. Scutellum polished, rather rugulose than punctured, the middle of the base impressed. Hemelytra closely, confluently punctured, the punctures becoming exteriorly more minute; the posterior portion of the clavus, and a continuation of the same color to the base of the membrane, black; membrane dusky, or blackish, veins of the basal areole red. Wings more or less infuscated towards the tip, the veins blackish, costal vein red. Tibiæ more or less infuscated; tarsi yellow, blackish at tip.

"*Capsus sanguinarius* Say, MSS. So determined by himself. New Hampshire, Mr. Leonard."

Length to tip of membrane, 8 millims. Humeral breadth, 2 millims.

No. 97, ♂, Dr. Harris' Collection.

A specimen from Canada in my collection has the inward half of the hemelytra black, from behind the base of the clavus along its whole breadth to the base of the membrane. The membrane is sometimes black, and the wings nearly so. I am indebted to the generosity of Mr. Scudder for a specimen from North Carolina.

PHYTOCORIS Fallen.

1. P. inops, n. sp.

Pale ash-gray, with a tinge of green; form more slender than in *P. nubilis* Say; legs and antennæ very slender. Head long, pale yellow, tinged with brown, sparingly clothed with long white hairs having a few black ones intermixed; spots at base, apical one-third of tylus, mottlings of cranium and oblique streaks each side, transverse stripe below the antennæ, a broader one below this running the whole length of the head and interrupted only by the eye, and bucculæ, dark brown; underside of head yellowish white; eyes large, oblique, subreniform, emarginate below; rostrum reaching the middle of the venter, yellow, infuscated at tip, first joint longer than the head, second and fourth subequal in length, third nearly equal to the first; antennæ yellowish white, a little longer than the entire insect, basal joint much stouter than the others, equal in length to the thorax and head as far as the fore-line of the eyes, clothed with remote brownish white hairs, the upper side with a band at base, a broader one at tip and four or more spots on the middle, dark brown, beneath with a few brown mottlings; the three following joints pubescent, very slender, regularly attenuating to the tip, the second joint pale at base, equal in length to the third and fourth conjoined, the third pale at base and tip. Pronotum pale gray, or luteous sprinkled and spotted with gray or fuscous, clothed with cinereous and black pubescence, the posterior submargin with six patches of black setæ, the lateral ones being on the humeri, between these patches the surface including the edge is yellowish white. Scutellum yellowish brown, or greenish, finely pubescent. Hemelytra brown, pubescent, the costal margin speckled with whitish yellow; disk and base of the clavus, a large spot near the apex of the corium, covering also the base of the cuneus, and some streaks on the disk, cinereous or greenish; cuneous brown at tip; membrane brown, irrorate and spotted with whitish, the nervures of the basal areole also whitish. Pectus greenish yellow, brown at sides superiorly, where are also a few yellow spots; mesosternum brown. Coxæ and femora yellow, or greenish, the latter brown at tip, sprinkled and spotted with yellow, tibiæ yellow, anterior and intermediate ones with three brown bands, the latter with a brown trace at tip, posterior tibiæ sprinkled and spotted with brown, tarsi yellow, more or less infuscated, the tip and nails brown. Venter yellow, or greenish, the sides superiorly with a broad fuscous stripe, the disk and sides with a few reddish brown spots, the genital segment more or less infuscated. Length, 6–7 millims. Humeral breadth, $1\frac{3}{4}$ millims.

No. 53, Harris' Collection. "*Capsus inops* Say, MSS., determined by himself. Cambridge, Sept. 1, 1837. Dublin, N. H., Mr. Leonard. Milton, Mass., Aug. 15, 1832."

2. P. nubilus.

Capsus nubilus Say, Hemipt. New Harm., 22, 10.

No. 131, Harris' Collection, ♂. "Nashua, N. H., July 21, 1835." Another specimen with new, printed number 52.

This is a widely distributed species, common in various parts of the Union, and found also in Canada and Mexico. In Massachusetts I swept it from a species of Solidago, and from different kinds of herbs growing in and about damp spots. Near Baltimore it may be met with upon the *Cephalanthus occidentalis*, and occasionally upon blackberry bushes or grape vines.

TROPIDOSTEPTES.

Form oval, rather broad, broadest across the posterior part of the corium, abruptly deflected behind the line of the tips of the cunei. Head broad, vertical, broad and blunt at tip, cranium very convex, the occiput with a linear, transverse, entire carina connecting the eyes; eyes small, oblique, laterally prominent, reniform, subacute at the upper corner; cranial surface higher than the eyes, the front very convex, each side near the eyes deeply impressed; the frontal boundary impression sharply defined; sutures bounding the tylus deep, the tylus elongate-quadrilateral, with an impressed line upon each side; lateral superior lobe broad, convex, emarginated in front, the tip a little rounded, and subtruncate, inferior lobe longer, convex, subelongate-quadrate; rostrum stout, reaching to the posterior coxæ; antennæ short, slender, basal joint almost bald, the second joint a little more slender at base than tip, remotely pubescent. Pronotum about one-half as long as broad, disk posteriorly very convex; anterior margin with a linear, much elevated carina, posterior margin broadly rounded, lateral margins straight, acute; callosities prominent, transverse; humeri elevated, the angles abruptly rounded; anterior angles slightly rounded. Scutellum convex. Wings with no recurrent vein in the costal areole.

This genus is allied to Polymerus, but differs in having the head thick and blunt at tip, with the corresponding modification of the upper and lower cheek-lobes, the eyes smaller and not so prominent anteriorly, the tylus less elongated, and more curved inwardly at tip, and the lateral margin of the thorax straighter and more complete.

T. cardinalis.

Capsus cardinalis Say, MSS., determined by himself.

Bright scarlet, polished, coarsely, deeply, confluently punctured. Antennæ, eyes, tylus, base of labrum, membrane, cunei along the interior margin and behind the middle to the tip, also the adjacent portion of the corium as far as the membrane, black. Head paler red, smooth, polished; with a few punctures in the depressions near the eyes and antennæ. Pronotum paler in front, very coarsely, deeply, somewhat confluently punctured, the elevated lateral edge smooth, impunctured, surface below the edge coarsely punctured. Under side of head, sternal ends of coxæ, basal joint of rostrum, middle line of venter, and genital hook of male, yellow. Legs reddish black, or red, with a pale band at tip of the anterior and intermediate tibiæ, tarsi yellowish, or dusky, with a black tip. Venter pale red, or slightly infuscated, clothed with remote, prostrate, yellow pubescence; postpectus at sides, and surface of the hemelytra, minutely, remotely pubescent.

Length to tip of hemelytra, 5–6 millims. Extreme breadth of hemelytra, $2\frac{1}{2}$ millims.

No. 84, Harris' Collection, ♀. "Massachusetts, June 20, 1831." In my collection are specimens from Andover, Mass. (F. G. Sanborn), Chicago (Robert Kennicott), and Connecticut (E. Norton).

The rostrum is generally dusky, but sometimes yellow or reddish with a tinge of black, and the tip black.

Lopidea Uhler.

Elongate-oval, minutely pubescent, the sides subparallel. Head vertical, from the front to the occiput very short, face transverse, fully twice as broad as long, the front raised in the middle, grooved each side adjoining the eyes; eyes subhemispherical, large, very prominent, occiput transversely impressed, the carina higher in the middle; surface of the face not elevated beyond the line of the eyes; antennæ placed just below the lower line of the eyes, in length almost equal to the thorax and hemelytra together, the basal joint about as long as the breadth between the eyes, abruptly narrowed at base, second joint three times as long as the first, either cylindrical or tapering at each end, the third joint more slender, about two-thirds the length of the second, fourth about equal in length to the first; tylus beginning vertical, then curving obliquely backwards below, lateral lobes flattened, the superior ones small, elongate-quadrate, obliquely truncate; rostrum reaching upon the intermediate coxæ, the basal joint stout, reaching to the anterior coxæ, second joint compressed, much more slender, of about the same length as the basal one, third tapering, shorter than the second, about equal to the fourth, which tapers still more finely to the tip. Pronotum trapezoidal, about one-half broader than long, lateral edges strongly carinately elevated, the middle of posterior margin sinuated, deflexed; callosities oval, placed obliquely, detached, situated in a depression; point of contact of corium and cuneus deeply notched. Areole of membrane elongated, with the sides subparallel, triangularly narrowed from beyond the middle to the end.

L. media.

Capsus medius Say, Hemipt. New Harm., 22, 11. *Capsus robiniæ* Uhler, Proc. Ent. Soc. Phila., I, 24.

No. 126, Harris' Collection, ♂, ♀. "Cambridge, Mass., Aug. 1, 1834. On Robinia."

This is the yellow variety of *Capsus medius* Say, which greatly abounds during midsummer on *Robinia pseudacacia.* I have met with the red type of this species upon blackberry bushes.

Lygus Hahn.

1. L. lineatus.

Lygæus lineatus Fab., Syst. Rhyng., 234, 152. *Capsus 4-vittatus* Say, Hemipt. New Harm., 20, 5. *Calocoris lineatus* Stål, Hemipt. Fabr., 86, 3.

Nos. 80 and 106, Harris' Collection. "New Hampshire, Mr. Leonard. Maine, Randall, July. On grass, July, 1829."

This species is very widely distributed throughout North America. Specimens have passed through my hands, which were collected in Canada, British Columbia, Nebraska, and in almost all the States of the Atlantic coast, as well as in Mexico. Dr. Stål places it in the genus Calocoris Fieb., but it disagrees with Dr. Fieber's characters of the genus.

Determined as *Capsus 4-vittatus* by Mr. Say. In one pair the eyes are yellow, in the others they are black.

2. L. dislocatus.

Capsus dislocatus Say, Hemipt. New Harm., 21, 6.

Nos. 48, 59, 60, Harris' Collection. "No. 48, ♂, *Capsus trifidus* Say, MSS. Sept. 15, 1827. Var. New Hampshire, Mr. Leonard."

"No. 59, ♀, *Capsus lugubris* Say, MSS. On grass, June, Maine Randall."

"No. 60, ♀, *Capsus dislocatus* Say. On grass, June, Massachusetts." These names are from Mr. Say himself.

This is a somewhat common species occurring in Canada and in almost all the States east of the Rocky Mountains. I have taken many pairs *in coitu* near Baltimore, and commonly found the males black and the females yellow, with more or less of the dislocated black vitta on the hemelytra. But varieties occasionally occur which look very much like a cross between this species and *L. lineatus* Fab. Other varieties have a more or less sanguineous pronotum ; still others are negrine females, with only a few streaks of yellow. No. 59

is a female, almost entirely black. No. 48 is a female almost entirely orange-yellow above. But these last two varieties of the female have thus far been of rather rare occurrence.

3. L. lineolaris.

Coreus? lineolaris Palisot Beauv., Ins. Afr. et Amér., 187, pl. xi, fig. 7 (*C. linearis* on the plate). *Capsus oblineatus* Say, Hemipt. New Harm., 21, 7. *Phytocoris lineolaris* Harris, Ins. Injur., 200.

No. 8, Harris' Collection, ♂, ♀. "*Capsus oblineatus* Say. Cambridge, Mass., July 15, 1838. On potatoes and dahlias; abundant. Florence, Ala., Hentz, Jan. and Feb., 1836. North Carolina, Aug. 15, 1831–32; April 20; autumn of 1834; and Maine, Randall, May 9." Named *C. oblineatus* for Dr. Harris by Mr. Say.

This is the North American analogue of the European *Lygus campestris* Linn., if it be indeed anything more than a local race of that species. It is quite as variable here as the *L. campestris* is in Europe and is distributed over the greater part of North America, including the more temperate parts of the sub-arctic regions. In North Carolina and Tennessee it extends to the summits of the peaks more than 7000 feet above the level of the sea.

4. L. invitus.

Capsus invitus Say, Heteropt., 24, No. 21.

Form of *Lygus contaminatus* H.-Schf. Pale, obscure yellow; antennæ and transverse carina at base of head very slender, the former nearly as long as the hemelytra, the apical joint infuscated; surface of head polished, impunctured, clothed with short hairs; tylus slender, short; eyes brown, large, prominent. Pronotum smooth, very convex, sparingly hairy, finely, densely, mostly confluently punctured. Scutellum moderately convex, brighter yellow, closely and finely wrinkled and punctured, minutely pubescent. Hemelytra closely covered with yellow prostrate pubescence, finely, closely punctured; clavus embrowned, a brown cloud across the tip of the corium invading the base of the membrane, the membrane with a brown spot occupying the tip of the areole, behind this a marginal smaller brown spot, and still farther back a smaller one. Inferior surface and legs lighter yellow, the venter finely pubescent, shining, and more or less embrowned about the disk. Length to tip of hemelytra, 6 millims. Humeral breadth, $1\frac{3}{4}$ millims.

Specimens in my own collection from Massachusetts and Illinois are entirely pale soiled yellow, with the cranium, fore part of thorax and sides of hemelytra brighter yellow; while others have a dark stripe each side of pronotum extending upon the basal angles of the scutellum, with the hemelytral bands dark brown, and with several brown spots upon the membrane. I have a male specimen from Massachusetts, with the thorax, legs, and exterior part of the corium, green. A specimen from York Co., Pa., is dirty yellow, with the hemelytra soot-brown, excepting only the base, costal margin and cuneus. In Dr. Harris' specimen (♀) there is only a slight duskiness on the clavus, a faint cloud at the tip of the corium, and a vestige on the membrane about the tip of the cuneus. The veins of the areole are brighter yellow very slightly edged with dusky.

No. 46, Harris' Collection, ♀. "July 15, 1827. June 20, 1831." Determined as *C. invitus* by Mr. Say.

In Maryland this species sometimes abounds on the blossoms of the wild grapes, during June. The colors in life are bright pea-green, the hemelytra more or less tinged with yellow, and the markings olive-brown. When recently excluded, the colors are very pale, with but a faint tinge of green.

CAPSUS Fab.

C. capillaris.

Cimex capillaris Fab., Mantis., II, 305, 270. *Capsus capillaris* Fieb., Europ. Hem., 264, 10.

No. 95, Harris' Collection, ♀. "*Capsus abruptus* Say, MSS. Pennsylvania, Dr. Pickering." Named by Mr. Say.

A well known European species, no doubt accidentally introduced into this country. I have a specimen which was collected near New York city, and another was sent to me from Para, Brazil.

CAMPTOBROCHIS Fieb.

C. nebulosus.

Camptobrochis nebulosus Uhler, Hayden's Surv. Montana, 417.

Pale olivaceo-testaceous, ovate, robust, polished, coarsely punctured. Head black, polished, impunctured, transverse groove in front of the basal carina deep, the carina, a streak adjoining each eye, a short one on the middle of the face, another extending along the tylus, and one each side of the tylus, pale yellow; antennæ with short hoary pubescence, the basal joint black, polished, second piceous-yellow, obscured at base and tip, third and fourth obscurely piceous-yellow; bucculæ and setæ yellow, the rostral sheath more or less piceous, paler on the basal joint. Pronotum grayish testaceous, regularly convex, with deep, remote, black punctures, which are confluent near the sides, a large black cloud on the disk, and several vestiges about the sides and near the posterior margin; callosities black, smooth, but rather slightly elevated; collum, lateral carinæ, and posterior edge yellow, the lateral margins sinuated, deflexed, carinate on the edge; posterior margin broadly rounded, feebly sinuated on the middle and adjoining the humeri, humeral angles a little raised, broadly rounded; anterior angles almost rectangular, a little rounded; pleuræ black, margined with yellowish, and together with the anterior xyphus deeply, confluently punctured; sternum opaque black, posteriorly margined with yellow, the odoriferous glands pale yellow. Femora black, remotely whitish pubescent, obsoletely punctured, at tip pale yellow, knees with a black spot; tibiæ pale yellow, with two piceous-black rings a short distance below the knees and another at tip; tarsi pale yellow, more or less piceous at base and tip, nails blackish. Scutellum blackish piceous, confluently punctured, except at tip, each side of the base and on the apex is an ivory-yellowish spot. Hemelytra olive-testaceous, remotely punctured with brown, costal edge, base, the tip exteriorly, several large and occasionally coalescing spots beyond the middle and base, interior edge and apex of the clavus, interior corner and apex of the cuneus, dark brown; cuneus broad, short, acute, sharply incised at base; membrane transparent, the nervures of the areole, the middle of their margin, a small spot beyond and a vestige at base, brown. Venter black, polished, remotely, minutely yellowish pubescent, finely, remotely, obsoletely punctured; genital pieces of the female piceous. Length, $3\frac{1}{2}$–4 millims. Humeral breadth, $1\frac{1}{2}$ millims.

This species is in the collection, but without a number. "May 15.' Specimens in my own collection were captured in Canada, Maine, Massachusetts, Illinois, etc. In eastern Massachusetts I have beaten many specimens from the pine trees during all the summer months.

Plagiognathus Fieb.

P. obscurus.

Plagiognathas obscurus Uhler, Hayden's Surv. of Montana, 418.

Elongate-oval, dull black, or fuscous, clothed with yellowish pubescence. Head black or piceous, the occipital ridge pale, face transverse, moderately convex, obliquely inclining, smooth, sparingly pubescent; tylus rather abruptly prominent, cylindrico-convex, black, cheeks black, the superior lobe small, convex, the inferior lobe longer, subtriangular, acute at tip, gula black, bucculæ margined with yellow; labrum and setæ yellow, rostrum yellow, or pale piceous, shining, reaching a little beyond the posterior coxæ, the basal joint black, a little longer than the head; antennæ black, or blackish fuscous, minutely hairy, basal joint yellow at tip, the third and fourth joints paler than the others. Pronotum regularly convex, broader than long, polished, obsoletely wrinkled, rather more closely pubescent in the males than in the females; humeral angles a little prominent, subacute; posterior margin regularly bowed, the edge deflexed; lateral margins oblique, hardly sinuated, the sides steeply declining, the carinate edge blunt; anterior submargin collar-like, sinuated in the middle, the callosities very slightly elevated, broad and long, coalescing interiorly. Pectus piceous, or black, bald, shining, edges of anterior acetabulæ and xyphus, mesopleural piece, tegula and surroundings of the posterior acetabulæ, more or less yellow, sometimes tinged with piceous; anterior and intermediate femora slightly sprinkled with brown near the tip, posterior femora compressed, a little embrowned above and below, on the inner and outer faces with a few brown dots; knees with a black dot, tibial spines black, and each with a black dot at the base; tarsi more or less piceous at base and tip, nails black. Scutellum minutely, obsoletely rugulose, black, shining, having a yellow V formed by the tip of the lateral margins. Hemelytra black or piceous, closely clothed with yellowish pubescence, corium at base with a pale yellow elongated spot, which runs along the suture and slightly upon the clavus, a small spot at exterior tip, and the cuneus with a large spot touching the base, also yellow; membrane smoky brown, the basal edge, nervures of the areole, and a pale spot on the middle, yellowish. Venter piceous, minutely pubescent, the superior genital appendages of the male yellowish, the lateral appendages blackish. The deeply colored females usually have the venter black, more or less invaded by yellow, or whitish, spots on the middle and sides. Length, 4 millims. Humeral breadth, $1\frac{1}{4}$ millims.

No. 130, Harris' Collection, ♂. "Cambridge, Mass., July 14, 1835." The two specimens in this collection are males; the one a newly excluded specimen.

The species is widely distributed in the United States, and is found also in British Columbia and Canada. It sometimes swarms on golden-rod and ox-eye daisy in Massachusetts, Pennsylvania, and Maryland, during the greater part of summer.

RHOPALOTOMUS Fieb.

R. ater.

Cimex ater Linn., Syst. Nat., II, 725, 72; Fab., Ent. Syst., IV 178, No. 156. *Lygæus flavicollis* Wolff, Icon. Cim., tab. 4, fig. 32.

"*Capsus testudineus* Say, Mass." Named by himself. The variety with yellow thorax.

Nos. 43 and 59, Harris' Collection. "On grass, June 17, 1827. June 30, 1826." No. 59, "*Capsus lugubris* Say, MSS., also determined by Mr. Say. On grass, June, Maine, Randall." Another specimen with locality unmarked.

This is the black variety with yellow cranium. The species varies rather considerably in the thickness of the second joint of the antennæ. It is found from the extreme north of British America to the southern parts of the United States. In Europe it is also widely distributed.

HALTICOCORIS Dougl. & Scott.

H. pallicornis.

Salda pallicornis Fab., Syst. Rhyng., 115, 6. *Halticocoris pallicornis* Dougl. & Scott, Brit. Hem., 479, 1.

"*Capsus alticus* Say, MSS.," determined by himself.

No. 99, Harris' Collection, ♀. "New Hampshire, Mr. Leonard."

I can find no satisfactory characters to separate this from the European species to which it is here referred. By a direct comparison with foreign specimens it seems to be the same, although some specimens show a tendency to be yellow against the inner side of the eyes, and to have the front pair of legs entirely yellow. When fresh, the hemelytra are sprinkled with minute dots of prostrate silvery hairs. Dr. Fieber says the "body is coarsely punctured above." In all the specimens which I have examined from both sides of the Atlantic, the upper surface, particularly of the pronotum, is rather rastrated and shagreened than punctured. The anterior part, and occasionally the posterior part, of the pronotum is transversely wrinkled. In my collection are specimens from Illinois, Massachusetts, Pennsylvania, and Maryland. The species sometimes abounds near Baltimore around the edges of fields, in the month of July.

Dr. Harris' two specimens are females, of a dull black color, faintly marked with yellow adjoining the eyes; with the posterior tibiæ piceous at base.

Pamerocoris Uhler.

General form of *Anthocoris* Auctor. Head horizontal, much longer than broad, subconical, constricted at base, cranium horizontal, slightly convex, higher than the eyes; face long, triangularly narrowing, declining to the tip, clypeus transversely impressed before the eyes; eyes large, prominent, laterally suborbicular, vertical, almost embracing the gula; tylus slender, cylindrical, sharply separated from the clypeus, forming the extreme tip of the head, the sides contracted; superior cheek-like lobe higher than long, slightly convex, obliquely truncated in front, rounded above, inferior lobe sunken, subtriangular, subtruncate at tip; antennæ stout, cylindrical, inserted in an emargination below the middle of the forepart of the eye, longer than the whole body, basal joint extending about one-half its length beyond the tip of the tylus, stouter at apex than at base, second joint very long, cylindrical, densely pubescent, rather more than three times the length of the basal, third and fourth much more slender, densely pubescent, each somewhat longer than the basal one; rostrum very long and slender, gradually narrowing to the tip, reaching beyond the middle of the venter, basal joint stout, compressed, a little longer than the head, second reaching to the back of the anterior coxæ, apical joint about as long as the basal one, but very slender, and acute. Pronotum subcampanuliform, the anterior margin with a slender, raised collar, the anterior lobe convexly elevated, the sides rounded, posterior lobe much broader, flattened, the lateral edge acute, carinate, the humeral angles produced; posterior margin broadly sinuated; the anterior lobe separated from the posterior one by a slightly impressed, waved line. Scutellum longer than wide, acute at tip, the base transversely elevated, behind this deeply excavated each side, the lateral edge slenderly carinated, almost to the tip. Prosternum depressed, at tip acute, the lateral margins much elevated. Coxæ long, stout, compressed, the anterior ones much longer and stouter than the others; legs long, femora compressed, slenderly channelled on the outer and inner faces, the anterior pair stouter and broader than the others, the posterior pair longest; tibiæ very slender; tarsi very long, the basal joint longest, middle one very small, the apical one shorter than the basal. Hemelytra flat, a little bowed on the costal margin, which edge is thick and elevated;

cuneus long, conically triangular, the basal margin bowed; membrane long, subtriangularly rounded at tip, the basal areole large, elongate-subquadrate, triangular at base, extending from the base of cuneus almost to its tip. Venter subcylindrical, much narrower than the hemelytra.

P. anthocoroides.

Piceous-black, elongate oval. Head smooth, impunctured, eyes pale piceous around the orbit, the facets very large; sides of face inferiorly, and tip of tylus rufous; antennæ yellow, more or less infuscated, densely pubescent, the basal joint less so, that joint piceous with a yellow tip; rostrum pale yellowish, more or less infuscated at tip. Pronotum dull black, sparsely pubescent, polished on the elevated disk of the anterior lobe, neck constricted; the lateral margins very oblique; the posterior margin almost twice the length of the anterior margin; posterior lobe slightly scabrous, depressed, the humeral angles obliquely produced, upturned, somewhat liguliform, rounded at tip. Anterior area of pectus wrinkled; coxæ yellowish white, femora piceous, or rufous, tipped with yellow; tibiæ and tarsi yellowish white, or slightly infuscated. Scutellum piceous or rufo-piceous, a bright orange spot each side of disk, and the tip acute, pale yellowish. Hemelytra yellowish white, minutely scabrous, sparsely, minutely pubescent, infuscated at base, and with a large fuscous cloud from the middle to the tip, (sometimes fuscous, with a pale disk to clavus, and a pale spot on the disk of corium), cuneus fuscous, with a round yellow spot at base; membrane fuliginous. Postpectus and venter rufous, the latter piceous in the middle; the genital attachments more or less orange. Length, to tip of tegmina, 3–3½ millims. Humeral breadth, 1 millim.

No. 96, Harris' Collection, ♂. "July 20, 1831."

This is a very interesting addition to the family, and supplies one more link to the chain of connection between the Phytocoridæ and Anthocoridæ. At a first glance it might readily be confounded with some of the larger species of Anthocoris.

IDOLOCORIS Dougl. & Scott.

I. famelicus.

Pale yellow, more or less rosy, polished, somewhat opaque on the clavus. Face yellow, tinged with rosy, head behind the eyes rosy, smooth, shining; eyes large, prominent, brown; cranium often having a brownish, or red, line on the middle; antennæ as long as the hemelytra, the basal joint stout, narrower at base, about as long as the head and neck together, yellow, red at base and tip; second joint twice the length of the first, thickened at tip, yellow, a little embrowned at base and broadly blackish at tip; third more slender, a little shorter than the second, fuscous, yellow at base; fourth a little longer than the basal one, fuscous, paler at tip. Rostrum slender, reaching to the base of the venter, testaceous, piceous at tip. Pronotum yellowish, smooth, the anterior lobe yellow, or rosy, opaque, callosities bright yellow, polished, margined before and behind with red; posterior lobe white, obsoletely punctured and shagreened, tinged with rosy on the sides and humeral angles. Pectus yellow, polished, more or less tinged with red; legs yellow, slender, the tarsi infuscated at tip. Scutellum yellow, tinged with rosy, opaque, minutely pubescent, obsoletely carinated on the middle line. Hemelytra yellow, finely pubescent, the clavus red on the middle, corium margined inwardly with red; on the disk posteriorly and reaching to the cuneus is an oblong red spot, exterior to this a streak which coalesces with a small spot at the base of the cuneus; cuneus at tip, and veins of the basal areole of membrane red, or reddish brown; membrane yellowish, translucent, a little clouded at the tip. Venter smooth, yellow, more or less rosy, particularly on the sides and anal segment. Length, $4\frac{1}{2}$ millims. Thoracic breadth, hardly 1 millim.

No. 101, Harris' Collection, ♂. "New Hampshire, Mr. Leonard". *Capsus famelicus* Say, MSS., so determined by himself.

A variety has the whole disk of the corium red; while another variety is almost entirely yellow.

TINGIDIDÆ.

Tingis Fab.

1. T. ciliata.

Tingis ciliata Say, Hem. New Harm., 26, 1. *Tingis hyalina* H.-Schf., Wanz. Ins., v, 84, fig. 532.

No. 140, Harris' Collection, ♂, ♀. "Florence, Ala. January and February, 1836, Prof. Hentz."

One specimen with a printed label No. 178, belongs here.

This widely distributed species lives, sometimes in vast swarms, upon the underside of leaves of sycamore. Although often met with on many kinds of trees, shrubs and plants, particularly when they grow adjacent to the sycamore, I have not yet discovered the young brood feeding upon them. But on the sycamore, the undersides of the leaves are frequently blackened by numbers of the young, sucking the juices from the midrib and its branching veins. In Maryland I have observed them to extend to the topmost leaves of sycamores more than fifty feet from the ground. Senility, or ripe maturity, is expressed in these, as well as in some others of the Heteroptera, by the pruinoseness of the inferior surface of the thorax and abdomen.

Trees growing in sheltered places and near water-courses seem to be most affected by them; but I have examined many trees in high and exposed places without finding a single specimen. They hibernate beneath loose bark and stones in sheltered places.

2. T. arcuata.

Tingis arcuata Say, l. c. 27, 3. *Tingis juglandis* Fitch, Third Report, 1856, p. 466, No. 193.

No. 61, in part, Harris' Collection, ♂, ♀. "*Tingis marmoratus* Say, MSS. On trees in great numbers. Florence, Alab. January or February, 1816; Prof. Hentz. One from New Hampshire, Mr. Leonard."

Three of the specimens in this collection are of the darkest variety, common in Maryland upon the black-walnut. A type from Dr. Fitch enables me to compare his species with that of Mr. Say, and I find no characters to separate them.

3. T. marmorata.

Form similar to that of *T. arcuata* Say. Body black, the humeral region and pleural margins sometimes paler, or piceous; the venter polished, minutely, transversely wrinkled. Bucculæ highly elevated, white; antennæ slender, the apical joint sometimes dusky. Pronotal vesicle high, extending far forwards, regularly arching over the head, abruptly compressed anteriorly for more than half its length; the meshes large, two larger ones occupying the basal breadth; the nervures more or less embrowned, that of the middle carinate, much elevated, entire. Most of the nervures with short spines, which in some specimens are obsolete. Lateral lobes of pronotum short, prominent, semicircular, having the same curve anteriorly as posteriorly; narrower than the base of the hemelytra, with large, rather regular cells; the nervures of the middle tinged with brown; a brown spot exteriorly and sometimes a second spot at the posterior margin; the marginal spines long and slender. Processus divided into cells as far as the tip; only the base of the lateral margin elevated, the middle carina high, not so high as the pronotal vesicle, gradually declining to the tip, the base arched, bearing two large areoles surmounted by a series of smaller ones, the upper edge spinous. Raised margin of the sternum whitish, the metasternum circular, auriculate each side. Legs pale honey-yellow, embrowned at tip and on the tarsi. Hemelytra rather quadrangular, with the basal angles, very acute, very widely removed from the pronotal lateral lobes, the basal margin distinctly concave; lateral margins spinous until a little beyond the middle, the tips widened, bluntly, broadly rounded; areoles large, next to the apical series is a transverse row of three or four very large ones, usually connected with another large one in front exteriorly; vesicular elevations small, with a high carina, spinous, bearing posteriorly a brown spot; a brown spot exteriorly near the basal angle, another submarginal near the middle, and a broad brown band at tip which omits the subapical series of large areoles.

Length, 3 millims. Breadth at base of hemelytra, $1\frac{1}{2}$ millims.

This species is most nearly related to *T. gossypii* Auctor., of the West Indies. In some specimens the surface of the processus is almost completely embrowned.

The two specimens of this species in the Harrisian collection present marked differences in color; the one, a male, being almost destitute of brown markings, having only pale indications where the spots should be. "North Carolina, Prof. Hentz." Dr. Harris attached No. 61 to the pins of these specimens, no doubt mistaking them for varieties of the preceding species.

ANTHOCORIDÆ.

Lyctocoris Hahn.

L. domesticus.

Cimex domesticus Schill., Isis, 1834, p. 738. *Anthocoris bicuspis* H.-Schf., Nomencl. Entom., 50. *Lyctocoris domesticus* Uhler, Proc. Bost. Soc. N. H., 1871, p. 106.

No. 143, Harris' Collection. "Alabama, February, and North Carolina, Prof. Hentz."

After a severe, critical comparison of specimens from different parts of North America with a series from Europe, I can find no permanent or important differences between them. There is a decided clearness of color in some specimens which strongly contrasts with the dull uniformity of others, but the same feature is seen in the European specimens. Some specimens from the south of Europe exhibit a yellowish tint at the base of the hemelytra.

In Maryland they live beneath the loose bark of decaying trees, such as oak and liriodendron, but most likely are not confined to those kinds of trees. Specimens from beneath bark where the debris is wet and plastic are more robust, plethoric and darkly colored than others which I have found in drier spots. Recently, I have seen them running over the fruit of the raspberry.

Triphleps.

T. insidiosus.

Reduvius insidiosus Say, Hem. New Harm., 32, No. 5. *Anthocoris pseudo-chinche* Fitch, Second Report on Nox. Ins., 295.

The species is common in Massachusetts, and often swarms in midsummer on the flowers of *Leucanthemum vulgare.* During September and October they may be beaten from trees and shrubs. It extends over all the eastern United States and into Canada.

ACANTHIADÆ.

Acanthia Fabr.

A. lectularia.

Cimex lectularius Linn., Syst. Nat., II, 715. *Acanthia lectularia* Fabr., Syst. Rhyng., 112, 1. *Cimex lectularia* H.-Schf., Wanz. Ins., III, 17, fig. 242.

No. 62, Harris' Collection. "Beds."

This disgusting insect is widely distributed over Europe and most, if not all, of temperate North America. Forms from India and Africa differ from this and are probably distinct species. From the differences in the shape and size of the rudiments of hemelytra, it might be safely inferred that some specimens become almost, if not quite, fully winged. Specimens from the negro-quarters of the Eastern Shore of Maryland are often twice the ordinary size and covered with almost erect bristly hairs. A new species has recently occurred to me near Baltimore, which I took from a white oak tree.

ARADIDÆ.

Aradus Fab.

1. A. similis.

Aradus similis Say, Hem. New Harm., 28, 3.

Nos. 133 and 139 u., Harris' Collection, ♂, ♀. "Alabama, Mr. Hentz."

A single female of the typical form remains in the collection. It is found also in New York, Illinois and Maryland. No. 133 is a large female which has the third joint of the antennæ brown, instead of yellow; but agreeing in other respects with the type. This latter is from "Maine, April; Randall."

2. A. crenatus.

Aradus crenatus Say, Hem. New Harm., 28, 1.

No. 138, Harris' Collection, ♀. "January and February, 1836; Florence, Alabama, Mr. Hentz."

This is our largest species. The specimen is of a somewhat paler color than usual.

3. A. rectus.

Aradus rectus Say, Hemipt. New Harm., 29, 4. *Aradus affinis* Kirby, Fauna Bor. Amer., 279, 2.

No. 12, Harris' Collection. "*Aradus muticollis* Say, MSS., determined by himself. May 1–15, 1833 and 1835; April 22, 1829. May 20, 1829. Maine, Mr. Randall."

This species closely resembles *A. lugubris* Fallen, of Europe, and may prove to be only a local variety of that species. I have been permitted to examine specimens from Mackenzie River region, Canada, Newfoundland, Maine, Massachusetts, Maryland, California and Colorado.

4. B. acutus.

Aradus acutus Say, Hemipt. New Harm., 29, 2. *Aradus americanus* H.-Schf., Wanz. Ins., VIII, 115, fig. 880.

No. 18, Harris' Collection, ♂, ♀, ♀. "January and February, 1836; Florence, Alaba., Prof. Hentz." A nymph from "H. H., Aug., 1850."

A third specimen with the same number belongs to *A. similis* Say. One specimen loc.? with printed number 84 is a large ♀ *acutus*.

5. A. quadrilineatus.

Aranus quadrilineatus Say, Journ. Acad. Philad., IV, 326.

No. 18, Harris' Collection. "*Aradus penultimus* Say, MSS., determined by himself. Under rails, on the ground, July. May 10, 1835. August 10, 1837, Cambridge. North Carolina, April and May; Prof. Hentz."

Three specimens, one male and two females, are in the collection. They are quite darkly colored, but in other respects agree with the types. The manuscript name quoted above is an old one which Mr. Say set aside when he published the description of the species.

It occurs in Canada West, in many parts of New England, and more rarely in Pennsylvania and Maryland. In my collection is a specimen from Panama.

6. A. robustus.

Aradus robustus Uhler, Proc. Boston Soc. N. H., 1871, p. 104.

Dark fuscous, or rufo-piceus, with numerous close-set, short setæ over most of the surface; form of *A. quadrilineatus* Say. Head broad and short, deeply grooved each side, and the posterior part of the grooves still more deepened. Tylus narrow, high, rounded at tip; on the constriction behind it is a minute, elevated granule. Antenniferous processes stout, subacute at tip, extending almost to the tip of the first joint of the antennæ. Antennæ slightly flat, very broad; basal joint very short, shorter than the apical one; second longest, subfusiform, more than twice as long as the apical one, much stouter than the basal; third equally stout, a little more than one-half the length of the second; apical one a little longer than the basal, much narrower than the third, the tip subconical. Rostrum paler, slender, reaching to between the anterior coxæ. Pronotum transversely elongate-oval, more than twice as wide as long; the lateral margins remotely denticulated, the teeth being smaller and closer posteriorly; the anterior margin subtruncated, posterior margin lobed behind the humeri; disk with four elevated ridges, the lateral ones incomplete, curving inwards anteriorly, and on each humerus is a short ridge. Margins of the scutellum much elevated. Legs paler at base, the tibiæ pale yellowish, with the base, tip and a broad band on the middle black; tarsi tipped with black. Disk of corium usually reticulated with pale ferruginous, which includes also the two elevated nervures; membrane pale, marmorated with fuscous, bearing four long nervures. Tergum more or less ferruginous; venter very distinctly granulated, the middle line incised; postgenital flaps long and broad, obliquely approaching at tip. Sides of the apical segments broadly scalloped. Length, $5\frac{1}{2}$–7 millims. Humeral breadth, 2–$2\frac{1}{2}$ millims.

No. 82, Harris' Collection. "May 20, 1829."

The only specimen in the collection is a female, of a dusky fuscous, more clearly ferruginous on the venter. The femora in some specimens have a pale band or spot near the tip. Specimens have been sent to me from Canada, Massachusetts, Illinois, and a single female was found near Baltimore, on May 15. Occasionally the less mature individuals have the second joint of the antennæ pale.

Brachyrhynchus Lap.

B. granulatus.

Aradus granulatus Say, Hem. New Harm., 30, No. 7.

No. 113, Harris' Collection, ♂, ♂, ♀. "*Aradus granulatus* Say, MSS.? North Carolina, April, Mr. Nuttall. Alabama, February, Prof. Hentz." Determined by Mr. Say.

Four specimens now remain in the collection. But I have examined many others from Cuba, Maryland and Florida. In Maryland it is found occasionally, in May. No other of our species agrees with Mr. Say's description and I feel confident that this is really the one described by that anthor.

Aneurus Curtis.

A. inconstans.

Aneurus inconstans Uhler, Proc. Bost. Soc. N. H., 1871, p. 105.

Ferruginous, or rufo-fuscous; when deeply colored displaying a whitish spot upon the middle of the corium. Antennæ stouter than in the allied species, the second joint a little longer than the basal one, the third almost as long, or at least two-thirds as long as the fourth. Spines of the antenniferous tubercles acute, and a little curved. The other characters correspond with those of the allied species. Length, 6½ millims. Breadth of base of thorax, 2 millims.

No. 13, Harris' Collection, ♀.

This is "*Aradus sanguineus* Say, MSS." "Massachusetts, May 29, on a fence." A specimen labelled "April 8," belongs here.

It would be unsatisfactory to adopt the above manuscript name given by Mr. Say, as it does not apply to the moderately mature specimens, and not at all to the fully colored ones.

The following table includes all the species at present known to me.

A. — Coarsely granulated species.

Antennæ, second joint hardly longer than the basal one; third joint about one-half as long as the fourth.

1. *A. lævis* Fab. Europe.

Antennæ, second joint stout, longer than the basal one; third joint almost as long as the fourth.

2. *A. inconstans* n. sp. Mass.

Antennæ very slender, second joint more slender at base, much longer than the basal one; third joint less than one-half as long as the fourth; the fourth very long and slender.

3. *A. simplex* n. sp. New England.

B. — Minutely granulated, highly polished.

Antennæ, second and third joints subequal, neither longer than the basal one; the fourth longer than any two of the others conjoined. Antenniferous tubercles not denticulated.

4. *A. politus* Say. Florida and Cuba.

PHYMATIDÆ.

Phymata Latr.

P. erosa.

Cimex erosus Linn., Syst. Nat., II, 718, 19. *Cimex scorpio* De Geer, Mém., III, 350, pl. 35, fig. 13. *Syrtis fasciata* Gray, Cuvier Animal Kingdom, ed. Griffith, Ins., II, pl. 93.

No. 16, Harris' Collection, ♂, ♀. "On peach tree. On flowers of Achillea, etc. Sept. 20, 1821 ; August 5, 1828 ; July 18, 1831 ; Sept. 1837."

A very common species, inhabiting a large part of North America. It creeps along stealthily on the heads of flowering plants and bushes, plunging its beak into any unfortunate insect within its reach and sucking the blood. When carelessly handled it punctures the skin and produces a very severe pain. It abounds in the Southern States, and in various parts of Mexico and California. Another form, No. 137, "Florence, Ala., January, February, Mr. Hentz," in the collection, does not agree with any of the other descriptions, but in the absence of more and better specimens, I deem it improper to attempt a description.

A pair, ♂, ♀, without a number, Florida, Doubleday, belong to the variety with acute lateral angles.

NABIDÆ.

Coriscus Schrank.

1. C. ferus.

Cimex ferus Linn., Fauna Suec., 962; Syst. Nat., II, 731. *Nabis ferus* H.-Schf., Wanz. Ins., III, 31, fig. 252. *Reduviolus inscriptus* Kirby, Fauna Bor. Amer., 280, 1.

No. 9, Harris' Collection, ♂, ♀. "April 1, 1822. April 20, 1834. Mass."

Named *Miris vagans* ? Fab., by Mr. Say. The species appears but little like a Miris, and it is surprising that so close an observer as Mr. Say should confound the two genera. Although similar to the European *N. vagans* Fab., it is, nevertheless, sufficiently distinct from it. Our species is widely distributed throughout North America, and offers several varieties, particularly in the number and length of the nervures of the membrane. Harris says "does not seem to agree with the Swedish *vagans*."

2. C. assimilis, n. sp.

Miris brevidapex Say, MSS., determined by himself.

No. 57, Harris' Collection. "Under boards. April 21, 1822. May 15, 1834."

Of the same form as *N. dorsalis* Dufour, of Europe. The hemelytra shorter and the abdomen not so ample as in *N. ferus*. Color dull ochreous yellow, sometimes tinged with rosaceous. Form rather elliptical; pubescent. Head ochreo-testaceous, sparingly incanous pubescent, mixed with longer hairs; behind the eye a large blackish spot, and before the eye a blackish trace; tylus yellow, narrow, elevated, linear, very slightly broader at base; cranium a little flattened between the eyes, having two abbreviated fuscous lines extending from the ocelli and divaricating anteriorly. Antennæ testaceous, remotely pubescent, the tip of third and the whole of the fourth and fifth joints infuscated. Rostrum reaching to the intermediate coxæ, testaceous, piceous at tip. Pronotum gradually widening to the base, sparingly incanous pubescent; a longitudinal impressed dark line on the middle, with impressed waved lines like those of *N. ferus*; the posterior lobe a little flattened above, the sides emarginated before the humeri, the adjoining edge defined by a submarginal impressed line, the lateral carina sharply defined as far as the line behind the collum. Pectus paler than the upper surface, minutely pubescent; the pleuræ with an interrupted blackish vitta which becomes broader behind and is continued along the sides of the venter; meso- and metasternum deep black. Legs pale testaceous, a little incanous pubescent; the anterior femora transversely ribbed and dotted in irregular rows with brown, not so stout as in *M. dorsalis* Duf. Intermediate femora also ribbed, more sparingly dotted; posterior femora very minutely dotted, more obsoletely so posteriorly, rufescent at tip. Hemelytra darker testaceous, more contracted at base than in *M. dorsalis* Duf., the costal margin broadly arcuated; corium dotted with fuscous, on the extreme tip is a larger dot, and on the medial nervure usually two others between which the space is whitish. Membrane short, usually with a few longitudinal fuscous nervules; in the male almost confined to the inner side of corium, with a fuscous dot near the middle of base. Tergum ochreous, more or less tinged with sanguineous, with a dark longitudinal cloud along the middle; the connexivum thin and white, bounded interiorly by a red streak. Genital segment subquadrate, with an impressed line beneath, the apex emarginated; the lateral lamellar pieces broad, very acute at the anterior tip.

Length, 6–$7\frac{1}{2}$ millims. Length of pronotum, $1\frac{3}{4}$ millims. Humeral breadth, $1\frac{1}{4}$–$1\frac{1}{2}$ millims.

Dr. Harris' female is of the pale variety, with the membrane projecting a little beyond the tip of the abdomen; the nervules are long and straight, and there are only two transverse ones near the base inwardly. The venter polished, pubescent, with a slender black line along the middle reaching to the tip; the lateral blackish stripes not so dark as on the pectus. The male is of the usual ochreous type, but having less distinct black dots on the hemelytra. Costal margin of corium whitish. Specimens of this species have passed my examination, which were taken in Canada, Maine, and Maryland.

3. C. subcoleoptratus.

Nabicula subcoleoptrata Kirby, Fauna Bor. Amer., IV, 282. *Nabis subcoleoptratus* Reuter, Ofv. Vetensk. Selsk., 1872, p. 81, No. 1. *Nabis canadensis* Provancher, Canad. Nat., 1869. *Coriscus subcoleoptratus* Stål, Enum. Hemipt., III, 112, No. 1.

"New Hampshire, August, 1850."

The specimen belongs to the ordinary short-winged variety common in New England, Canada and New York.

A badly damaged Nabis, with printed number 513, is in the collection, but is not determinable.

METASTEMMA Amyot & Serv.

M. fusca.

Prostemma fuscum Stein, Berliner Entom. Zeitschr., I, 90, 4.

No. 44, Harris' Collection, ♀. "June 17, 1827."

The type of Dr. Stein's description, collected in Pennsylvania, seems to belong to the less mature condition of color, in which the deep piceous-black clypeus is replaced by rufo-flavus, or honey-yellow. In the Harrisian specimen the clypeus is rather flavo-piceous, and the basal margin of pronotum tinged with rufo-piceous. The lateral recurved margin of prothorax is only slightly rufous, and the abdomen, both above and below, rufo-piceous, clothed with remote yellowish hairs.

The darkest specimens have the pronotum all over deep black, highly polished, as also the upper side of the head; with the clypeus rufo-piceous, and only the base of gula yellow; the hemelytra fusco-piceus, and the membrane a little paler; the abdomen entirely deep black, polished. A specimen from Lake Winnipeg has legs almost entirely nigro-piceous.

REDUVIDÆ.

Melanolestes Stål.

1. M. picipes.

Pirates picipes H.-Schf., Wanz. Ins., VIII, 62, tab. 269, fig. 831. *Reduvius pungens* Leconte, Proc. Acad. Philad., 1855, p. 404.

No. 88, Harris' Collection, ♂, ♀. "Pennsylvania, Dr. Pickering. North Carolina, April, Mr. Nuttall. Louisiana, Mr. Eustis."

"*Reduvius striaticollis* Say, MSS.," determined by himself.

Two individuals now remain in the collection, labelled "Alabama." They are small specimens of the normal type, common to the Middle States; the legs and antennæ being deeper black than such as I have seen from Louisiana and Texas. It occurs also in Massachusetts. A specimen is in my collection, which was colleeted for me near Para, Brazil.

2. M. abdominalis.

Pirates abdominalis H.-Schf:, Wanz. Ins., VIII, 63, tab. 269, fig. 832.

Also No. 88, Harris' Collection.

A single pupa is in the collection, collected in North Carolina. It is sometimes very common in Maryland, and hibernates beneath stones. Dr. Harris probably never saw the adult insect, or he would not have included it in the same number as the preceding species. Although closely related in structure the two species seem to keep always apart, and notwithstanding that I have seen many pairs *in coitu*, I have never yet observed the two kinds to unite sexually.

RASAHUS Amyot et Serv.

R. carinatus.

Reduvius carinatus Fab., Syst. Rhyng., 278, 57; Coquebert, Illustr. I, 42, tab. 10, fig. 15. *Peirates carinatus* Serv., Ann. Sci. Nat., 1831, 10.

No. 111, Harris' Collection. "North Carolina, April, Nr. Nuttall. Louisiana, Mr. Eustis." Named *Nabis humeralis* by Mr. Say.

Two specimens of the normal form are at present in this collection. It occurs occasionally near Baltimore, beneath stones. I have examined specimens from California and Mexico which agreed with the usual form.

REDUVIUS Fab.

R. personatus.

Cimex personatus Linn., Fauna Suec., 942. *Cimex quisquilius* De Geer, Mém., III, 281, 25, pl. 15, fig. 7. *Reduvius personatus* Fab., Syst. Rhyng., 267, 7.

No. 6, Harris' Collection. "*Reduvius mimicus* Say, MSS., determined by himself. In houses, and under boards; flies by night, entering houses. August 1, 1822. June, 1826."

This European species is fully established, although not numerous, in the United States. I have examined specimens from Maine, Massachusetts, New York, Pennsylvania, Maryland and Georgia. After a comparison with European specimens, I find no difference to separate them as distinct species.

ONCEROTRACHELUS Stål.

O. acuminatus.

Reduvius acuminatus Say, Hemipt. New Harm., 32, 3. *Oncerotrachelus acuminatus* Stål, Ofversigt, 1867, p. 130.

No. 94, Harris' Collection. "Pennsylvania, Dr. Pickering."

In my collection there are specimens from Illinois and Maryland.

RHIGINIA Stål.

R. cruciata.

Petalocheirus cruciatus Say, Hem. New Harm., 33, 1. *Ectrychotes bicolor* H.-Schf., Wanz. Ins., VIII, 43, tab. 266, fig. 822. *Rhyginia crudelis* Stål, Stettiner Ent. Zeitschr., XXIII, 456, No. 320.

No. 51, Harris' Collection. "Philadelphia, Dr. Pickering."

The specimen is a male of great beauty, with long, perfect hemelytra extending quite to the tip of the abdomen. It was determined by Mr. Say. Dr. Stål's type came from Mexico, and by a comparison of ours with specimens from that country, I find no specific differences between them. It is of very rare occurrence in Maryland.

Hammatocerus Blanch.

H. furcis.

Cimex furcis Drury, Illust. Exotic Ent., III, 63, pl. 45, fig. 4. *Hammatocerus nycthemerus* Illig. Burm. Handb. Ent., II, 236, 1.

No. 136, Harris' Collection, ♂, ♀. "Florence, Alab., January and February, 1836, Prof. Hentz."

This species extends from Florida as far north as the Valley of Virginia. It varies in the amount of red on the hemelytra and legs.

Prionotus Lap.

P. cristatus.

Cimex cristatus Linn., Cent. Ins. Rar., 16, No. 41. *Reduvius novenarius* Say, Amer. Ent., I, pl. 31, fig. 2. *Arilus denticulatus* Westwood, Drury's Illust. of Exotic Entom., II, 73.

No. 76, Harris' Collection. "Pennsylvania, Dr. Pickering."

This is a common species in many parts of the Middle and Southern States, extending as far west as Texas. It inhabits small pine trees in the woods, and is occasionally found upon other kinds of trees in the streets of the cities of Baltimore and Washington.

I have no doubt that this is the true *Cimex cristatus* Linn., Amœn. Acad., VI, 399, No. 42, and Syst. Nat., 12e ed., tome I, pars 2, p. 723, No. 62. His description agrees with alcoholic specimens of our species, while it disagrees with the South American species figured by Drury, and described by Fabricius under the name *Reduvius serratus*, Syst. Rhyng., 266, 2. Moreover our species is the one living at Charleston, and other parts of the South, from the former of which places Dr. Garden sent the type of Linnæus' description. As no other species has thus far been found to inhabit South Carolina, and as the Fabrician species is the one cited by Amyot & Serville and others as synonymous with the Linnean *C. cristatus*, the evidence is all in favor of the well-known Carolinian species being the true type. Besides the greater number of teeth to the crest of the Brazilian form, as well as the rufous face and rostrum and structure of the fourth and fifth ventral segments abundantly separate that species from the *cristatus* = *novenarius* Say. Dr. Stål now concurs with me in considering this to be the true *C. cristatus* Linn.

MILYAS Stål.

M. cinctus.

Reduvius cinctus Fab., Ent. Syst., IV, 199, 20. *Harpactor cinctus* H.-Schf., Wanz. Ins., VIII, 82, fig. 858. *Milyas cinctus* Stål, Stettin. Ent. Zeitschr., XXIII (1862), 448.

No. 85, Harris' Collection. " North Carolina, Prof. Hentz. Pennsylvania, Dr. Pickering. Cambridge, Mass., Mr. Randall."

Determined as *Reduvius cinctus* by Mr. Say.

A specimen of each sex now remains in the collection. They are of the normal type, as it most commonly appears throughout the Atlantic region. Near the seacoast of New Jersey it is sometimes met with in great numbers on the small oak and hickory trees.

ZELUS Fab.

Z. longipes.

Cimex longipes Linn., Syst. Nat., I, pt. 2, 724, 65. *Zelus bilobus* Say, Ins. of Louisiana, 12. *Evagoras rubidus* Am. & Serv., Hem., 368. *Evagoras speciosus* Burm., Handb., II, 227, 3. *Evagoras tricolor* H.-Schf., Wanz. Ins., VIII, 45, figs. 817, 818. *Zelus longipes* Stål, Stettin. Entom. Zeitschr., 1862, XXIII, 449.

No. 124, Harris' Collection. " Louisiana, Mr. Eustis."

A single male without annulations upon the femora now belongs to the collection. The species varies very greatly, and is very widely distributed throughout sub-tropical America, including our Southern States and Mexico.

DIPLODUS Amyot & Serv.

D. luridus.

Zelus luridus Stål, Stettin. Ent. Zeitschr., 1862, XXIII, 452.

Nos. 20, ♂, and 35, ♀, Harris' Collection. "*Zelus acanthogonius* Say, MSS., determined by himself. May 30, 1826. June 1, 1829. June 20, 1822."

The description given by Dr. Stål applies to the faded female. When alive the female is apple-green with bright red eyes. The male is almost black on the hemelytra. Specimens of the first named sex become more or less fuscescent after death, and such is the type described by Dr. Stål. I regret that before meeting with the above description, I had sent specimens to various correspondents in this country and Europe, labelled *Evagoras viridis* Uhler. The latter name is the one I had given it in my MS., and of course it must fall before the published one of Dr. Stål.

In the collection is a cluster of the eggs, arranged in a single tier, forming a globular pellet, from which a larva has partly emerged. The species ranges from Canada to Florida, and west into Texas, and is perhaps represented in California by a variety.

ACHOLLA Stål.

A. multispinosa.

Cimex multispinosus DeGeer, Mém., III, 348, 23, pl. 35, fig. 10. *Reduvius sex-spinosus* Wolff, Icon. Cim., 124, tab. 12, fig. 118. *Harpactor subarmatus* H.-Schf., Wanz. Ins., VIII, 83, p. fig. 852. *Acholla sex-spinosa* Stål, Stettin. Ent. Zeitschr., XXIII, 286.

No. 5, Harris' Collection, ♂. "Trees, July–Nov. 1820. Oct. 15, 1836. Oct. 10, 1837."

Dr. Harris erroneously refers this to *Reduvius raptatorius* Say. His No. 37 is the true *R. raptatorious* Say. The specimens now remaining are all females, notwithstanding one is labelled with the ♂ sign.

SINEA Amyot & Serv.

S. diadema.

Cimex multispinosus De Geer, Mém., III, 348, pl. 35, fig. 11. *Zelus diadema*, Fab., Syst. Rhyng., 286, No. 18. *Reduvius raptatorius* Say, Amer. Ent., pl. 31, fig. 1; idem, Journ. Acad. Philad., IV, 327.

Nos. 37, ♂, 116, ♀, Harris' Collection. "June 30, 1826. Sutton Mass., Dr. Smith."

Determined as *Reduvius diadema* Fab., by Mr. Say.

One very much damaged male now remains in the collection; the female is so much mutilated as to be scarcely recognizable. The species is common in many parts of North America, including California, Mexico and Central America.

CONORHINUS Lap.

E. variegatus.

Cimex variegatus Drury, Illust., I, 109, pl. 45, fig. 5. *Conorhinus lecticularius* Stål, Berlin. Ent. Zeitschr., III, 107, 1.

No. 87, Harris' Collection, ♂, ♀. "North Carolina, Prof. Hentz. South Carolina, Mr. Curtis."

"*Reduvius* (*Petalocheirus*) *sanguisugus* Say, MSS.," determined by himself.

This species is known to me from Illinois, Georgia and Florida, and recently a specimen has been captured in Maryland. It differs from the *C. sanguisugus* LeConte; that species has been redescribed by Dr. Stål under the name *C. lateralis*.

The species of this genus are said to freqnent beds and sleeping apartments in the far South, and in Ohio and Illinois.

STENOPODIDÆ.

PYGOLAMPIS Germar.

P. pectoralis.

Reduvius pectoralis Say, Ins. of Louisiana, 11; Entomol., ed. LeConte, I, 306. *Pygolampis fuscipennis* Stål, Ofv. Vetensk. Akad., 1859, p. 380, 4.

No. 30, Harris' Collection, ♂. "May 15, 1826."

The above name by Mr. Say was sent from him to Dr. Harris.

One male alone remains; measuring a little more than half an inch in total length. In general, specimens are larger. I have seen specimens from Massachusetts, New York, Chicago, southern Illinois, Maryland, Florida aud Texas.

EMESIDÆ.

EMESA Fabr.

E. longipes.

Cimex longipes De Geer, Mém., III, 352, pl. 35, figs. 17, 19. *Ploiaria brevipennis* Say, Amer. Ent., III, pl. 47. *Emesa pia* Am. & Serv., Hem., 394, 2. *Emesa filum* Gray, Cuvier An. King. Insects, II, 244, pl. 97, fig. 3. *Emesa pia* H.-Schf., Wanz. Ins., IX, 114, fig. 937. *Emesa longipes* Uhler, Proc. Bost. Soc. N. H., 1871, p. 107.

No. 93, Harris' Collection, ♂. "Pennsylvania, Dr. Pickering, Dr. Gould."

Determined by Mr. Say to be his *P. brevipennis.*

Two badly mutilated and five other specimens of both sexes, without a number, are in the collection. They are of the usual type common to Pennsylvania and Maryland.

Through the kindness of Prof. Verrill, of Yale College, I have been able to examine a series of specimens from New Haven, a pair, ♂, ♀, from Bloomington, Ind., and a male from Long Island. I have also compared them with specimens from North Carolina and other southern states, and found an agreement in structural characters. The suffusion with red and distinctness of the white bands on the legs depend upon individual peculiarities, such as maturity and rank feeding, and cannot serve to distinguish the species. The species referred to *E. brevipennis* Say by Dr. Dohrn, Linnæa Ent., vol. XIV. p. 220, No. 3, is not the true type. Mr. Say's species was collected in Philadelphia, and his description agrees with the common form from that locality. The species of Dr. Dohrn is as yet unknown to me, and will probably prove to be distinct from the preceding.

The figure of Mr. Gray no doubt represents a male, while that of Herrich-Schaffer is an obese female, full of maturing eggs. Specimens in the latter condition are common late in summer, and present a very gross appearance, and seem very different from the clearly colored virgin types found earlier in the season.

EMESODEMA Spin.

G. simplicipes.

"*Ploiaria simplicipes* Say, MSS.," determined by himself.

Clay-yellow, or dull ashy-fuscous; moderately stout. Head broad, above almost flat, minutely granulated; the lobes almost equal, the posterior one subtruncated at base, each side of which there is a group of more elevated granules; the middle line grooved from the base to a little before the transverse impressed line, the under surface pale yellowish. Sides of the head infuscated, more coarsely granulated, the eyes black, composed of few facets; process of the tylus long, slender, acute at tip, projecting considerably in advance of the labrum; rostrum reaching to the anterior legs, pale-yellowish, the basal and second joints subequal, the apical one much longer, very slender. Antennæ very slender, the basal joint hardly thicker but much longer than the second, third joint exceedingly short. Pronotum wider than the head, a little narrowed behind, emarginated on the posterior middle, obsoletely roughened, pubescent, longer than the mesonotum; pectus distinctly granulated; postpectus longitudinally carinated. Meso- and metanotum each widened behind, both shagreened and with a common ridge each side extending behind the end of the scutellum. Scutellum trapezoidal, the narrow end behind. Anterior legs robust, the femora compressed, pale testaceous, faintly clouded with brown, almost white beneath, the teeth extending over two-thirds the length from the tip, the posterior spine much the longest, white tipped with black, three or four others not so long, and with numerous short ones between; the tibiæ less than one-half the length of the femora, faintly banded with whitish. Intermediate and posterior coxæ conical, the trochanters knob-like; the intermediate femora not as long as the abdomen, not apparently banded; the posterior femora a little longer than the abdomen. Abdomen more than three times as wide as the thorax, pubescent, obsoletely shagreened, infuscated on the sides and middle of the segments, the sutures pale; connexivum with about five pale dots, below the connexivum each side of venter is a broad blackish vitta; the venter distinctly granulated, its middle line carinated. Length, 9 millims. Greatest breadth of pronotum, $\frac{2}{3}$ millim.

No. 58, Harris' Collection, ♀. "June 17, 1827; Dr. Pickering, Salem, Mass."

This insect must be related to *Emesodema Carolina* H.-Schf., but the different length of the pronotum at once serves to distinguish it from that species.

Only one much damaged female is now present in this collection.

PLOEARIA Am. et Serv.

P. errabunda.

Ploiaria errabunda Say, Hemipt. New Harm., 34, 2; Uhler, Proc. Bost. Soc. N. H., 1871, p. 197. *Ploiaria maculata* Hald., Proc. Acad. Philad., III, 151.

No. 107, Harris' Collection. "New Hampshire, Mr. Leonard."

The only specimen now present is somewhat immature and lacks the legs and antennæ. Prof. Haldeman generously gave me the type of his description, and by comparison with the specimen of Dr. Harris, I find the two to be identical.

The above name by Mr. Say was sent by himself to Dr. Harris.

SALDÆ.

SALDA Fabr.

1. S. ligata.

Acanthia ligata Say, Hemipt. New Harm., 34, 1.

No. 141, Harris' Collection, ♀. "*Acanthia maritima* Harris, MSS., Cambridgeport, on salt marshes, July 20, 1836."

This pretty species is common throughout a considerable part of the Atlantic region. In Maryland it most abounds on rocks which project above the water in rapid streams.

2. S. interstitialis.

Acanthia interstitialis Say, Journ. Acad. Philad., IV, 324.

No. 77 (u), Harris' Collection. "*Acanthia alternata* Say, MSS., named by himself. May 15, 1837. On salt marsh ? Dr. Green. Ponds, May 16, 1838."

This species must not be confounded with the one which follows. Dr. Harris has attached the same number to both, as if considering them to be the same; but the longer and narrower pronotum will at once serve to distinguish the latter. The *S. interstitialis* inhabits the far northern parts of British America; most parts of the region north of the Ohio River on the west, and the Atlantic region on the east.

3. S. separata.

Black, minutely, sparingly pubescent above; general form of *S. interstitialis* Say. Head large, eyes brown, large and very prominent; face minutely, densely punctured, clothed with erect hairs; cranium wider than in the preceding species, having a small yellow spot each side against the eyes, on a line with the amber-yellow ocelli; lower margin of the clypeus recurved, the tylus and labrum bright yellow, the rostrum, excepting its immediate base, piceous, extending a little beyond the base of the posterior coxæ. Antennæ black, the basal joint yellow, black underneath excepting the base and tip; the second joint almost twice as long as the basal, third longer than the basal and shorter than the fourth. The base of head longer than in the preceding species. Pronotum obsoletely punctured, hardly polished, clothed with erect pubescence; the sides oblique, slightly curved, the callosities more polished, connate, forming a single transverse elevation, with a rounded pit in the middle; behind it is an impressed, punctured line. Pectus polished black, obsoletely wrinkled, sparingly pubescent. Legs testaceous; the coxæ more or less infuscated; anterior femora black on the middle underneath, the intermediate and posterior pairs with a black spot beneath near the tip, and clothed with thick, whitish pubescence; tip of tibiæ and also of tarsi blackish. Hemelytra dull black, obsoletely rugulose, sparingly clothed with erect pubescence, widest just behind the middle; the corium with a yellow dot on the exterior margin near the tip, usually also with three or four more minute ones on the middle suture and one at tip of clavus. Membrane sometimes whitish, with a large black spot at the base inwardly, a small subquadrate one against the base exteriorly, and behind this an orange spot which is bounded behind by another black spot; the nervures blackish. Others have the membrane black, with a yellow spot against the exterior margin and a few pale vestiges on the middle. Venter, black, more or less tinged with piceous, polished, very remotely pubescent, minutely inconspicuously punctured, tip of the genital segment broadly white. Length 4–4½ millims. Humeral breadth, 1½ millims. Extreme width of hemelytra, 2 millims.

One specimen now remains in the collection. I have seen specimens from Canada West, New Hampshire, Massachusetts and Pennsylvania.

S. coriacea.

Form of *S. littoralis* Linn. of Europe.

Uniform black, highly polished. Cranium broad, densely, minutely shagreened, minutely pubescent, faintly grooved on the middle line; before the ocelli are two raised tubercles, placed far apart; face hairy; tylus and labrum yellowish, the rostrum piceous, reaching to the posterior coxæ; eyes large, prominent, brown, very oblique; antennæ black, slender, the second joint sometimes pale piceous, more than twice as long as the basal joint; the third and fourth subequal. Pronotum trapezoidal, very narrow anteriorly, the sides very oblique, hardly arcuated, the lateral edge broadly recurved; the surface minutely shagreened, pubescent; callosities obsolete, their locality a little convex, with an indented, punctured transverse line behind; posterior angles acute, the posthumeral margin very acutely oblique. Legs honey-yellow, infuscated on the tip of tibiæ and on the ends of the tarsal joints. Pectus highly polished, remotely, minutely pubescent, minutely wrinkled. Scutellum minutely, densely granulated. Hemelytra very convex, widest far behind the middle, very highly polished, remotely, coarsely, rather obsoletely punctured; the clavus bounded on the inner submargin and outer suture by an indented line of punctures; membrane coalescing with the corium, indistinctly piceous, and with three faint yellowish spots between the longitudinal nervures, near the tip. Venter brilliant black, closely, minutely punctured, clothed with sparse, fine pubescence. Length, 6–7 millims. Humeral breadth, 2 millims. Extreme width across hemelytra, 3½ millims.

No. 63, Harris' Collection. "*Acanthia coriacea* Say, MSS.;" named by himself.

Some specimens have large yellow spots on the posterior margin of the antepectus, and yellow coxæ; the femora have a broad black cloud on the under side. Two specimens now belong to the collection, both of which appear to be males.

"Cambridge, Mass., June 20, 1834. Salem, Mass., Dr. Pickering. Near water in Cambridgeport, July 20, 1836. On sand near water."

This species extends far north in British America, and is not uncommon in New England and Pennsylvania.

VELIIDÆ.

Rhagovelia Mayr.

R. obesa.

Rhagovelia obesa Uhler, Proc. Bost. Soc. N. H., 1871, p. 107.

Allied to *R. collaris* Mayr (Burm.), but differs in the colors, in the more contracted abdomen with its acutely produced posterior tips of the connexivum, and in the absence of dense long hairs at the tip of venter in the same sex.

Brownish, or bronze-black; the under side bluish, sericeous; when very mature less polished, but more densely powdered with bluish, or cinereous bloom. Head black, velvety, the front almost truncated, cinereous, with an impressed longitudinal line running almost to the base, a few long hairs about the sides and above; the cranium a little elevated on the middle, extending back in the form of a triangle; the base of the occiput transversely a little carinately elevated. Labrum and lateral lobes yellowish, or rufo-piceous; rostrum black, reaching to the tip of the anterior coxæ. Eyes round, brown. Antennæ black, excepting the base of the basal joint, less hairy than in *R. collaris*; the basal joint stoutest, curved, about twice as long as the second joint, the second subequal to the third, the fourth decidedly shorter than the third. Thorax obese, the pronotum velvety blackish, sparingly clothed about the sides with fine golden pubescence; collum with an orange band which is interrupted in the middle; middle line faintly carinated; the tip of pronotum produced at tip, curved upwards, its extreme end expanded, emarginated, and each process granulated; the humeri prominent in the winged individuals, in the unwinged it is obliquely rounded. Pectus bluish, sericeous, each side of prosternum broadly orange. Coxæ, trochanters, and usually the base of femora, yellow; the femora bronzed or bluish-black, minutely hoary pubescent; the tibiæ and tarsi duller black; posterior femora of the males stouter than of the females, in both with a yellow, black-tipped, curved spur beyond the middle, and from it to near the tip series of minute teeth. Abdomen moderately compressed, (very strongly compressed in the unwinged females) minutely sericeous, pubescent, excepting on the middle of tergum, which is bald, shining black; the raised upper edge of the connexivum orange, in the female its posterior tips produced into long slender spines. The middle of the ante-genital ventral segment of the male quadrately, broadly flattened, each side of which a little elevated. Basal genital segment of the female broadly black on the middle. The cerci of the male are long, slender, curved, hairy processes. Length, $3\frac{1}{2}$–4 millims. Breadth of pronotum, $1\frac{3}{4}$ millims.

I am deeply indebted to my much lamented late friend, Dr. James B. Bean, of Baltimore, for ample series of this species from the mountain and valley streams of eastern Tennessee and western North and South Carolina. The specimens from the valleys are mostly winged, while none of those from the great altitudes are so. For a period of fifteen years I have observed these insects in Maryland, eastern Virginia and Pennsylvania, and have also seen many specimens from Massachusetts and Canada, but from these localities always without wings. The cognate species, *R. collaris* Mayr, is very common on the surface of the Grand Anse River in Haiti; where I observed and collected both winged and unwinged individuals from a single colony. Having the true *R. collaris* Burm. in my collection, I am thereby enabled to mark the differences between it and our new species. The *R. collaris* Burm. is also a native of Cuba, from which locality I have examined specimens.

HYGROMETRIDÆ.

Hygrotrechus Stål.

1. H. remigis.

Gerris remigis Say, Hemipt. New Harm., 35, 1.

No. 15? (sic) Harris' Collection, ♂. No. 14, ♀. "Charles River." "Larva, July 20, 1827."

One individual of each sex, labelled "Maine." I have examined specimens of this species from many parts of the United States and Canada. It is quite common, and sometimes abounds in Maryland; but near Baltimore it is never winged. Individuals differ in color, many being reddish brown, or ferruginous on the base of the pronotum, but the most usual color is fusco-olivaceous. The emargination of the last ventral segment (♂), together with the shorter, robust cerci will distinguish this species from its nearest allies. The cerci in the present specimens are a little shorter than usual. Determined as *G. remigis* by Mr. Say. Another specimen, with printed number 144, is in the collection.

2. H. conformis, n. sp.

"*Velia collaris* Say, MSS., named by himself. On water, September 30."

Dull olivaceo-fuscous, occasionally a little reddish brown on the base of the pronotum; form rather more slender than that of *H. remigis*; the eyes more prominent. Pronotum invested with short, dense, olivaceous pubescence, the middle line of anterior lobe impressed, orange; the posterior lobe coarsely, deeply, in places confluently punctured, with a slender elevated longitudinal line running along the whole length; lateral edge narrowly yellow. Antepectus pale yellow, powdered with white; under sides of the anterior and intermediate coxæ and outside of the posterior coxæ pale yellow. Medio- and postpectus grayish sericeous. Hemelytra blackish brown, not reaching to the top of the ante-genital segment; tergum black, minutely, transversely wrinkled, the connexivum minutely punctured, lateral raised margin yellow, the apical processes slender, acuminate, as long as the segment to which they are attached. Venter cinereous, sericeous minutely pubescent, the posterior margin of the last segment deeply concave, and together with the under side of the genital segments rufescent. Male. Length to tip of venter, 15–16 millims. Greatest breadth of pronotum, $2\frac{3}{4}$ millims.

The lateral margin of pronotum has a stout ridge terminating in a knob on the humerus, and between the humeri are two smaller protuberances, which are sometimes obsolete.

No. 14, Harris' Collection, ♂. "September 20, 1821. Charles River."

A fully winged male is the only specimen in this collection. The other specimen with the same number is the female of *H. remigis* Say. This species was formerly very common on the streams near Baltimore, but it is now seldom met with; it occurs in summer.

Limnotrechus Stål.

L. marginatus.

Gerris marginatus Say, Hemipt. New Harm., 36, 2.

No. 29, Harris' Collection. "*Gerris humilis* Say, MSS., so named by himself. Water, July 20, 1827, May 15, 1826, and Maine, Mr. Randall, April and May."

It seems strange that Dr. Harris did not recognize in this the *Gerris marginatus* Say. It agrees in all respects with the description of that insect and the size there given will hardly apply to any other of our species. Although offering slight differences of color and form, it comes very near to *L. lacustris* Linn. of Europe, and it may yet prove to be but a local, or climatic form of that species. One male and two females now belong to the collection.

Limnoporus Stål.

L. rufoscutellatus.

Gerris rufoscutellatus Latr., Gen., III, 134, No. 2; Stoll, Punaises, tab. XV, fig. 108. *Limnoporus rufoscutellatus* Stål, Öfv., 1868, p. 396.

No. 15, Harris' Collection. "*Gerris marginatus* Say, MSS., so named by himself. Pond, Sept. 20, 1821."

The specimen in the collection is a female of unusually small size. After a close comparison of several individuals from various parts of North America with specimens from Europe, I can find no permanent differences to separate them. The species appears to be northern and it has only twice been taken as far south as Maryland.

Halobates Esch.

H. pictus.

Halobates pictus H.-Schf., Wanz. Ins., VIII, 111, figs. 882, 883.

A single poor specimen now remains to represent this species. In my own collection may be found specimens from Andover, Mass., kindly collected for me by Mr. Francis G. Sanborn.

This species is widely distributed, extending as far south as Cuba; from which locality I have specimens sent to me by Prof. Felipe Poey, of Havana. I once found a winged female near Baltimore. It was swimming about in the midst of a large group of unwinged specimens, and notwithstanding my repeated search, I have not since met with another winged individual. Among the mountains of North Carolina and Tennessee it is likewise unwinged, but commonly more slender than is usual in the types from Maryland.

Metrobates Uhler.

Robust and broad. Winged form: head very convex, a little slanting forwards, between the eyes narrower than long, much narrower than the pronotum; eyes very large, viewed from above placed obliquely, subglobose, moderately prominent, their upper surface below the line of the vertex, projecting widely over the sides of the pronotum; with one or two impressed lines running across near the middle. Antennæ stout, almost as long as the entire body, the basal joint nearly as long as the three others conjoined, curved at base, and narrowing in that direction, much stouter in the male, and a little expanded at tip, the under side with erect hairs; second joint about one-third the length of the basal one, greatly enlarged at tip; the third shortest, enlarged at tip; fourth very stout, fusiform, almost as long as the second. Rostrum stout, hairy, extending beyond the basal line of the prosternum. Pronotum ample, (in the unwinged form narrow and short, with the mesothorax forming the largest division of the body) a very little wider than long, the posterior lobe large and extending back in the form of a broad triangle, with the sides nearly straight and the tip a little rounded; lateral margins (including the humeri) constituting high, broad ridges. Anterior lobe much narrower than the head across the eyes, the lateral margins and submargins lobately elevated. Anterior legs stout, the tibiæ a little curved at tip, with the process small and almost in contact with the surface on which it is situated; basal joint of tarsi about one-fourth the length of the second, the second carrying the unguiculi about one-third of its length from the tip. Intermediate femora about two-thirds the length of the posterior; the tibia not quite as long as the posterior femur and tibia conjoined, but equal in length to the distance from the base of head to the tip of the intermediate femur; tarsus equal in length to the posterior tibia and tarsus conjoined. Hemelytra not covering the whole width of mesothorax, but much longer than the body; corium short, having two elongated cells occupying nearly the whole width; the nervures very prominent, membrane more than twice as long as the corium, having a submarginal nervure running around the entire circumference, following equally the curve of the tip, a longitudinal suture extends along the middle quite to the tip. Abdomen broad and short; the penultimate ventral segment of the female concavely curved on the posterior margin.

M. hesperius.

M. hesperius Uhler, Proc. Bost. Soc. N. H., 1871, p. 109.

Opaque, velvety blue-black, or brown-black, densely pubescent, robust, the mesothorax very large and composing the larger part of the body. Head convex, robust, brown, at base rufous, or orange, the anterior part of which is invaded by a rounded spot of the black surface extending from the face; minutely, densely pubescent; rostrum black, shining beneath, densely grayish pubescent above, more or less orange at base. Antennæ black, pubescent, the basal fourth of the first joint orange. Pronotum very small in the unwinged specimens, less than one half as long as wide, having the anterior margin a little concave; the surface closely, finely pubescent, the anterior lobe with a yellow, depressed spot on the middle, covered by a more or less wide gray, or lead-blue middle line, which color expands and covers the whole width of the tergum to its tip, omitting only a few black streaks on the disks and margins of the segments. The whole breast, venter, and two spots on the pleura lead color, with a sericeous gloss.

The winged form has the pronotum blackish brown, densely pubescent, the middle of the anterior lobe broadly depressed, covered by an orange spot, lacking the bluish stripe. Coxæ yellow beneath, legs brownish black, the anterior pair yellow at base, and on the under side the yellow is a little farther extended. Sternum blackish, each side of it yellowish. Hemelytra dark brown, with a faint paler streak on the medial suture, the base and costal margin pubescent. Venter cinereous, the disk of the penultimate and base of the last segment yellow.

Length to tip of hemelytra, 5 millims. Extreme width of mesothorax, 2 millims. Unwinged, length 3–4 millims. Width of mesothorax, $1\frac{3}{4}$–$2\frac{1}{4}$ millims.

No. 29, Harris' Collection. "Water, July 20, 1827; May 15, 1826, and Maine, Randall, April, May. 245 & 246."

The label is marked "larva," as if taking it to be the larva of *Limnotrechus marginatus* Say. The unwinged form is very common in summer, on the surface of the Charles River, Mass., near Waltham. At that place I saw numbers of solitary individuals skimming the surface at a considerable distance from the shore. In Maryland it usually congregates in groups of a score or more on the surface of still pools near the banks of streams. It is quite common in North and South Carolina, but no winged specimens have yet occurred to me from either of those States. In Haiti, on the Grand Anse River, the winged form abounds, usually in company with the unwinged. Within a period of twelve years, this species first made its appearance on Gwynn's Run, near Baltimore; a few years earlier it was not to be found on that stream.

NAUCORIDÆ.

NAUCORIS Geoff.

N. Poeyi.

Naucoris Poeyi Guerin (non Amyot), Icon. du Règn. Animal, 353, pl. 57, fig. 5.

Five specimens are in the collection, labelled "Florida, Doubleday," and without a number attached. They differ in no respect from specimens collected in Cuba, Maryland, Illinois, and Massachusetts.

GALGULIDÆ.

Galgulus Latr.

G. oculatus.

Naucoris oculata Fabr., Syst. Rhyng., 111, 5. *Galgulus oculatus* Latr., Hist. Nat. Ins., XII, 386, pl. 95, fig. 9.

No. 67, Harris' Collection, ♀. "In brooks, leaping like a frog. North Carolina, Prof. Hentz." Determined by Mr. Say.

The above observation may apply to the beds of brooks from which the water has been withdrawn. These insects do not live in the water, but on muddy spots where the water has previously stood, or on the damp banks of pools and streams, among the grass or stones.

They vary very much in colors and size. The most brightly colored specimens being of a clay brownish, speckled with silvery spots. Others are dull rufous, greenish, dirty brownish, or clay brownish, with a large black cloud on the disk. In Maryland, the species appears in May; a few stragglers have also been taken in August.

NEPIDÆ.

Nepa Linn.

N. apiculata.

Nepa apiculata Harris, Ins. Mass., 1862, pl. 1. fig. 1.

No. 26, Harris' Collection. "*Nepa apiculata* Say, MS. Under stones near water. May 15, 1826."

The principal differences between our species and the European one consist in the color of the tergum, which is red in the latter, fuscous in ours, and in the length of the apical tubes, which in ours are stouter and shorter. A single specimen only, lacking the apical tubes, remains in the collection.

Ranatra Fabr.

1. R. fusca.

Ranatra fusca Beauv., Ins. Af. et Amér., 235, pl. 20, fig. 1. *Ranatra nigra* H.-Schf., Wanz. Ins., IV, 32, tab. 290, fig. L, head.

No. 65, Harris' Collection. "*Ranatra fusca* Beauv. Pond, Taunton, May 23, 1827 ; June 10, 1829. Cambridge, Oct. 1, 1832.' Determined by Mr. Say.

This species is sometimes very common in eastern Massachusetts. Mr. E. P. Austin kindly presented to me several specimens of both sexes, collected in Fresh Pond, Cambridge. These, in common with many other hemiptera, become suffused with rufous color, no doubt arising from a ripe maturity of development.

2. R. quadridentata.

Ranatra quadridentata Stål, Ofv. af Koenigl. Vet. Akad. Förh., 1864, p. 204.

An imperfect specimen, without locality indication, seems to belong to this species. It is found in Mexico, and more rarely in various parts of the United States. A good specimen without the locality, is in the collection.

BELOSTOMIDÆ.

Zaitha Am. et Serv.

Z. fluminea.

Belostoma fluminea Say, Hemipt. New Harm., 37, No. 1. *Perthostoma aurantiacum* Leidy, Journ. Acad. Philad., 2d ser., I, 60.

No. 74, Harris' Collection. "*Belostoma fluminea* Say, MS., determined by himself. Salt pond margin, May 1, 1825, and Ipswich, Mr. Oakes, Sept. 5, 1832. Found in great numbers in the stomach of a duck."

This species is common in many parts of the Union, sometimes appearing in great numbers about the muddy beds of streams, beneath the stones, early in autumn. The female seems to be the broader form of the two sexes. A specimen is in the collection with printed label No. 335.

Benacus Stål.

B. griseus.

Belostoma grisea Say, Hemipt. New Harm., 37, No. 2. *Belostoma Haldemanum*, Leidy, Journ. Acad. Philad., 2d ser., I, 66. *Benacus Haldemanus* Stål, Öfv. Kong. Vet. Akad., Forh., 1861, p. 205. *Belostoma angustatum* Guerin, La Sagra, Hist Nat. Cuba, 420.

No. 108, Harris' Collection. "North Carolina, April, Mr. Nuttall."

Occasionally occurring in most of the regions near the eastern coast of the United States, from New England to Forida. It inhabits Cuba, also, from which place I have a specimen, sent to me through the kindness of Prof. Felipe Poey.

Belostoma Lat.

B. americanum.

Belostoma americanum Leidy, Journ. Acad. Philad., 2d ser., I, 66. *Belostoma grandis* Fab., var. *americanum*, teste Leidy.

Nos. 66, 109, Harris' Collection. "*Belostoma americana* Fab., *Belostoma grisea* Say MSS., determined by himself." "Pond at Sweet Auburn, Cambridge, Oct. 20, 1831. No. 109, *Belostoma sordida* Harris' Catalogue. Cambridge, September and October. Maine, Mr. Randall, 1836."

The name *B. americana* does not occur in the published writings of Fabricius; and if not merely one of his manuscript designations, it may have originated with some of the older entomologists in the United States.

It is also so closely allied to *B. annulata*, H.-Schf., belonging to South America, that the comparison of a series of specimens from the two localities may prove them to be the same species. The specimens in this collection consist of a very large individual, measuring 50 millims in length, and of a very small one, measuring 43 millims.

NOTONECTIDÆ.

Notonecta Linn.

1. N. insulata.

Notonecta insulata Kirby, Fauna Bor. Amer., 285, No. 399. *Notonecta rugosa* Fieber, Rhyng., 52, No. 7. Var. *plagiata*, et var. *cordigera.*

No. 17, Harris' Collection. "July 1, 1823."

Two varieties of this species are present. Those above cited in Fieber's Monograph seem to be of rare occurrence in New York, where the species is quite common. Thus far I have failed to obtain specimens of these varieties in Maryland, although Dr. Fieber indicates Baltimore as the locality for them. Determined as *N. noveboracensis* Forster (*maculata* Oliv.) var. by Mr. Say. Another specimen in the collection has a printed number 402, attached to the pin.

2. N. undulata.

Notonecta undulata Say, Hemipt. New Harm., 39, 1. *Notonecta variabilis* Fieber, l. c. 53, No. 8. Var. *maculata.*

No. 17, β, Harris' Collection. "Rivers and ponds. Sept. 20, 1821. May 15, 1828, ♂, ♀." Determined by Mr. Say.

Four varieties remain in the collection, noted β. γ. δ. ε. The variety γ differs only a very little from the tye of *maculata* Fieber; but besides this, the species offers almost every possible variation between that with the broad black band and streaks, to that without a vestige of dark marking. It varies also in size, ranging from 9 to 12½ millims in length. *Notonecta lineata* Forster, Nov. Ins. Spec. p. 70, is probably one of the varieties of this species, but the description is not full enough to limit it with precision. The length given by this author, $\frac{1}{6}$ inch, is erroneous; it is far too small for any species yet known to science. Gmelin in Linn. Systema Naturæ, vol. IV., 2119, unwarrantably changes Forster's specific name to *N. noveboracensis*, while, at the same time he gives only a part of the description from that author.

3. N. irrorata.

Closely resembling *N. insulata* Kirby, but proportionally more robust. Velvety black beneath and on the hemelytra. Face white, eyes more closely approaching at base, the occipital, transverse carina absent; vertex coarsely punctured, the punctures continued forward and downward in double or triple series adjacent to the eyes The longitudinal ellipse of the face faintly punctured with brown, and sometimes, in addition, a brown streak reaches to tip of the clypeus. Pronotum smooth, yellowish, obsoletely, coarsely punctured, transversely, rather deeply impressed, anterior to which transversely wrinkled; sometimes the anterior and posterior margins embrowned, and with a round spot near the middle anteriorly; the lateral margins elevated, sinuated anteriorly, the anterior angles blunt, posterior ones prominent, rounded, the posthumeral margin sinuated, the posterior margin not quite straight. Scutellum dull black, not apparently punctured. Propleura smooth, yellow, with the lower margin black; pectus black, clothed with very long hairs. Legs orange-yellow, or pale piceous, sometimes tinged with green, and streaked with brown; the bristles and teeth dark brown, the ciliæ golden rufo-flavous; the nails piceous. Hemelytra velvety black, minutely golden pubescent; finely punctured; the corium confluently dotted and spotted with ochreous, particularly at base, the spots behind the middle and those adjoining the costal margin few and remote; embolium ochreous margined with black; membrane black, more or less flecked with ochreous, the tip pale brown, with a paler spot before it. Venter black, polished, having dense, long, blackish ciliæ on the middle ridge and lateral suture; the connexivum whitish or green, closely punctured, with the sutures of the segments blackish; tergum ochreous, clouded with fuscous at base and tip, the posterior margins of the segments fuscous; the superior surface of the connexivum ochreous, with quadrate, fuscous spots. Length, 13–15$\frac{1}{2}$ millims. Humeral breadth, 4$\frac{1}{2}$–5 millims.

"Ipswich, March, Mr. Oakes. Milton, Mass, April 22, 1829."

Mr. Say calls this *N. noveboracensis* Forster, but it does not agree with that author's description, nor with that of Gmelin, who quotes the characters originally given. Still less is it the European *N. maculata* Oliv. Two other specimens without numbers are in the collection.

CORISIDÆ.

Corisa Am. et Serv.

1. C. calva.

Corixa calva Say, Hemipt. New Harm., 38, 1. *Corisa calva* Fieb., Spec. Gen. Corisa, 19, 12.

No. 134, Harris' Collection. "Maine. May 1, 1836." "Probably only a variety of No. 105." Harris.

It is by no means a variety of No. 105, as the structure of the palæ will show at a glance.

2. C. Harrisii.

Blackish fuscous, not quite so broad as *C. interrupta* Say; the upper surface of the pronotum and of the hemelytra, except at tips, distinctly, uniformly rastrated. Head pale yellowish, a little broader than the pronotum; face with a few rows of large punctures each side, frontal fovea not very deep, oblong-oval, extending a little way above the lower line of the eyes, sparingly clothed with very long golden bristles; posterior margin carinately elevated, embrowned, the middle a little produced, dark brown; the eyes brown, or lead-color. Pronotum very nearly twice as broad as long, fuscous, with eleven slender, yellow, slightly curved bands, which do not touch the lateral margin; one or two on the disk and one at posterior tip uniting at either end with the one preceding or succeeding. Posterior margin yellow, bluntly triangular, with the apex a little rounded; pleura and parapleura pale yellow. Legs yellow, tibiæ a little broader than the palæ, the upper margin bowed; palæ broad, elongate-subquadrate, a little obliquely narrowing to the base, the apex obliquely subtruncated, a little decurved, the upper angle rounded, feebly prominent, the lower angle almost blunt, the indented tip carrying an oblique row of coarse punctures, the middle line of inner face depressed, the raised edge bounding its lower side minutely, closely denticulated, the comb of ciliæ arising from this ridge long, golden-yellowish; the upper submargin and margin with rows of very minute teeth, and near the tip a few long ciliæ; the outer face broadly sulcated. Intermediate and posterior tibiæ with brown spines; the edges of the posterior tibiæ and tarsal paddles and a streak on the middle of the former dark brown. Mesosternum, except its posterior margin and parts of the pleural pieces adjoining it, also the bases of the coxæ, blackish; posterior xyphus long triangular, subacute, yellow, except at base. Hemelytra having the yellow lines very slender; on the base of clavus straight, entire, on the disk and beyond it arranged in series of three or four across the width, somewhat dislocated, a few of them angulately waved, or bifurcated at one end. Lines of the corium waved, a few at base entire, behind the base short, placed in dislocated series, those on the exterior margin a little broader, sometimes a few bifurcated; on the membrane they are broader, placed transversely, but much more tortuous, those at the tip much smaller, more irregular, with the ends near the inner margin straight and placed subequidistantly, and at the base of membrane a fuscous cloud. Epipleura dull sordid yellowish, sparingly, minutely, yellowish pubescent, the outer margin, a streak at base and a cloud at apex fuscous; embolium a little infuscated. Wings milky white. Tergum blackish, the connexivum yellowish, having a few oblique streaks of brown, the anal segments pale at base and at the margins; venter yellowish, ciliated with long yellowish hairs, the surface with sparse yellowish pubescence, the three basal segments blackish, excepting the sides and posterior margins; genital segments with a broad fuscous arc common to the two; the inferior surface of connexivum with a few streaks of brown. ♂. Length, 9 millims. Breadth of pronotum, 3 millims.

Female, from Massachusetts in my collection. Palæ broad and long, cultrate, the upper margin minutely denticulated, the outer side sulcate and on the middle line a series of remote, setigerous, coarse punctures; the lower margin a little concave, ciliated, with minute teeth between the ciliæ, the apex and above it bearing a few long bristles; the carinate edge of the middle line with a comb of minute teeth on the inner surface. Same size as the male.

No. 22 β, Harris' Collection. Called a variety of *C. interrupta* by Mr. Say. One damaged male is the most that now remains to represent this species in the present collection. A badly damaged specimen with printed label 501, is also in the collection.

3. C. interrupta.

Corixa interrupta Say, Journ. Acad. Philad., IV, 328, 1.

No. 22, Harris' Collection. Named by Mr. Say.

A small, badly damaged female is all that remains to represent this species. It is five lines long; the palæ are broadly falcate, acuminate, as in the allied species.

This is by no means the insect which Dr. Fieber, "Species generis Corisa," p. 27. No. 28, refers to Say's species. Dr. Fieber mistakes Say's insect, and probably had never seen the description of it, since he misquotes the authority, and refers only to the Hemiptera of North America, where the description does not occur.

No. 202 with red label seems to be a variety of this species, but in its present damaged condition no accurate determination can be made.

4. C. alternata.

Corixa alternata Say, Journ. Acad. Philad., IV, 322, 2.

No. 105 ? Harris' Collection. "Maine, Mr. Randall. May 9, 1836. New Hampshire, Mr. Leonard."

Determined by Mr. Say.

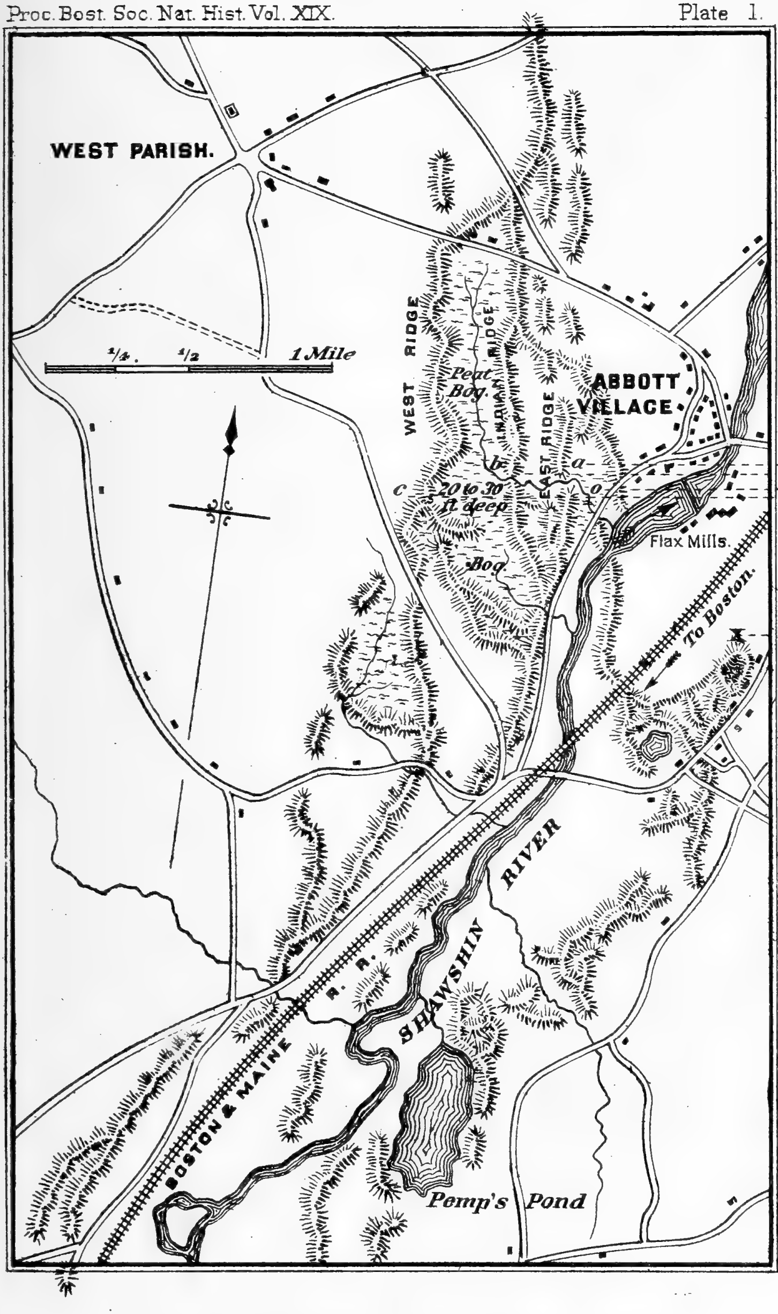
Two females, the one 9 millims, the other 8 millims in length are present, the smaller one agreeing very well with the description of Mr. Say. The larger one is no doubt a variety of this species.

The No. 105 without the ? is a distinct species, but the specimen is too badly disfigured for correct description.

Doubtless many species yet remain to be discovered in Massachusetts and the other New England States, and the close collector will be abundantly rewarded by the capture of new and interesting forms. The present collection lacks many species which are known to be common in Massachusetts.

INDEX TO VOL. XIX.

The names of genera and species described as new are italicised.



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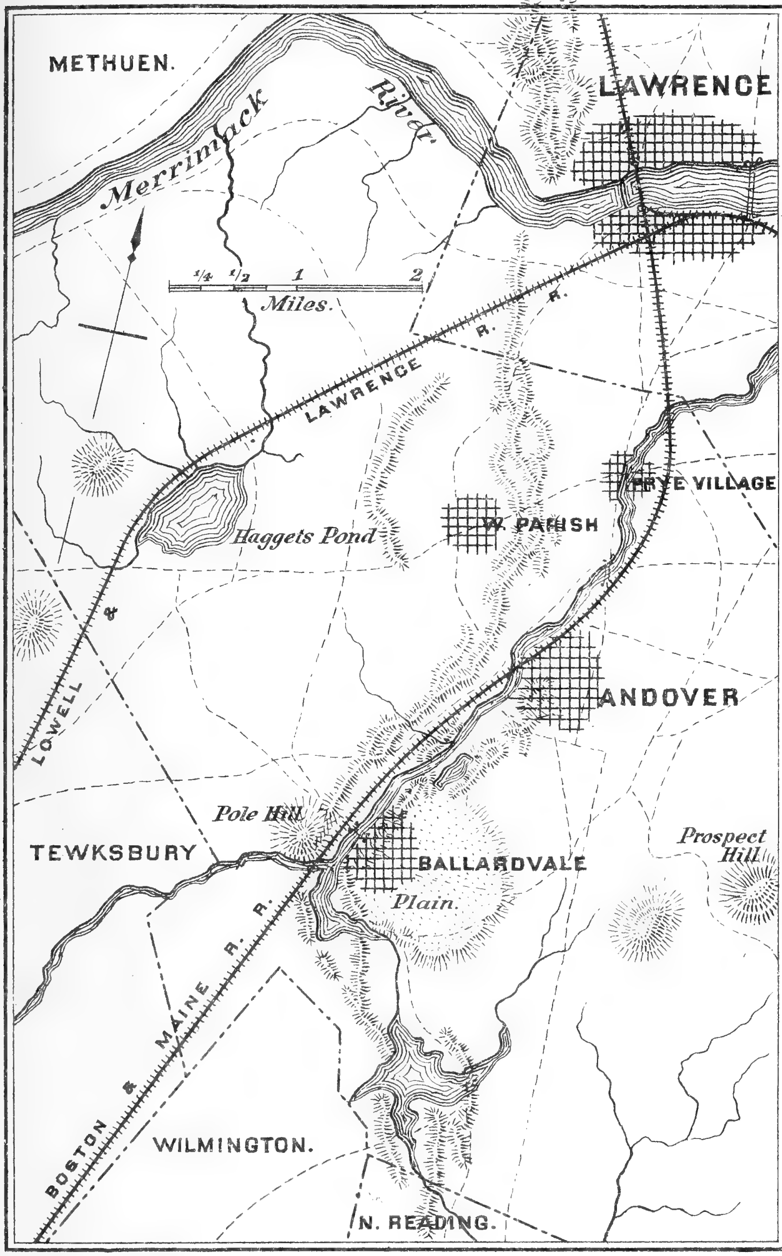

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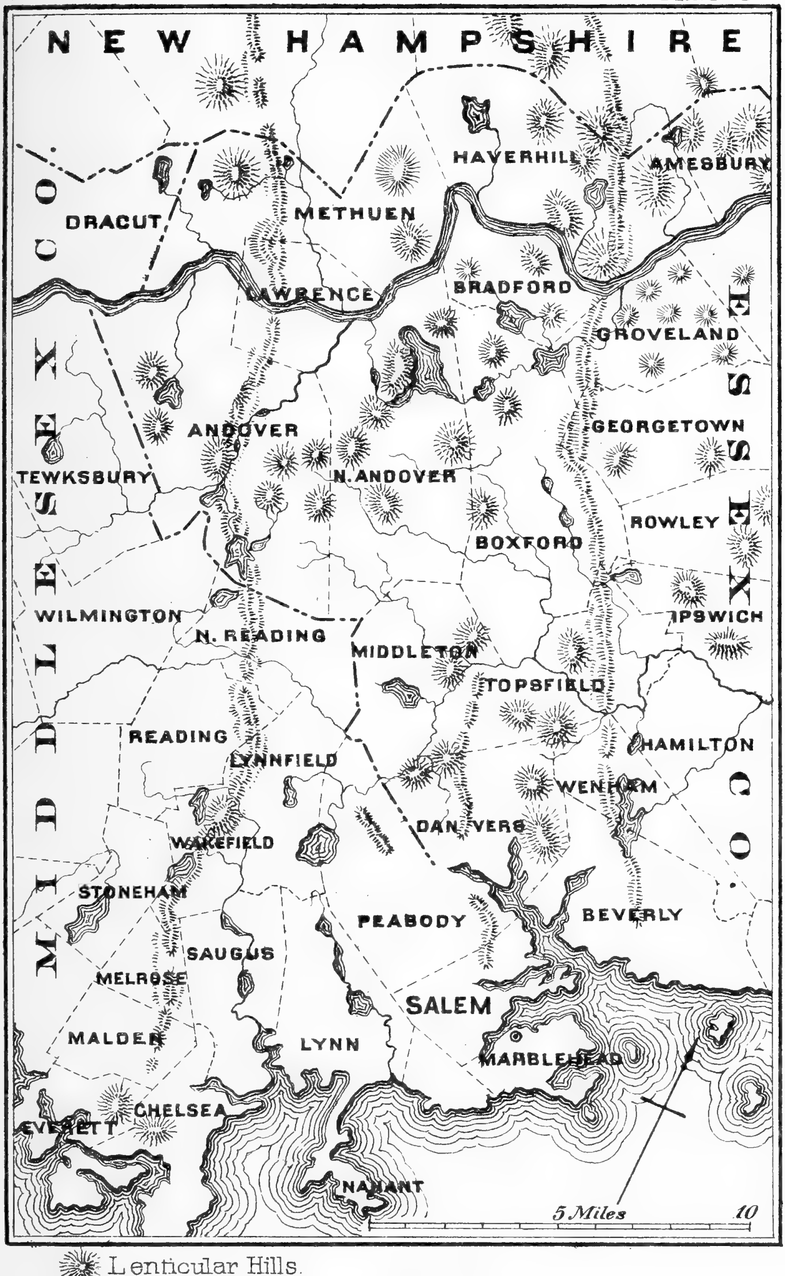
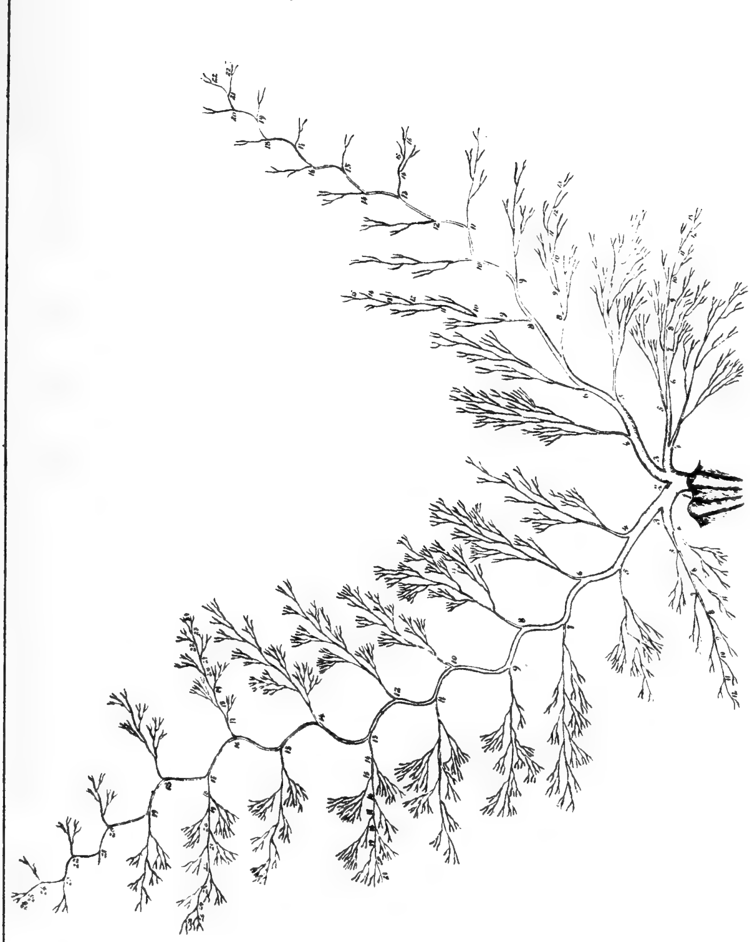


Lenticular Hills.
Gravel Ridges.

WRIGHT, REMARKABLE GRAVEL RIDGES.



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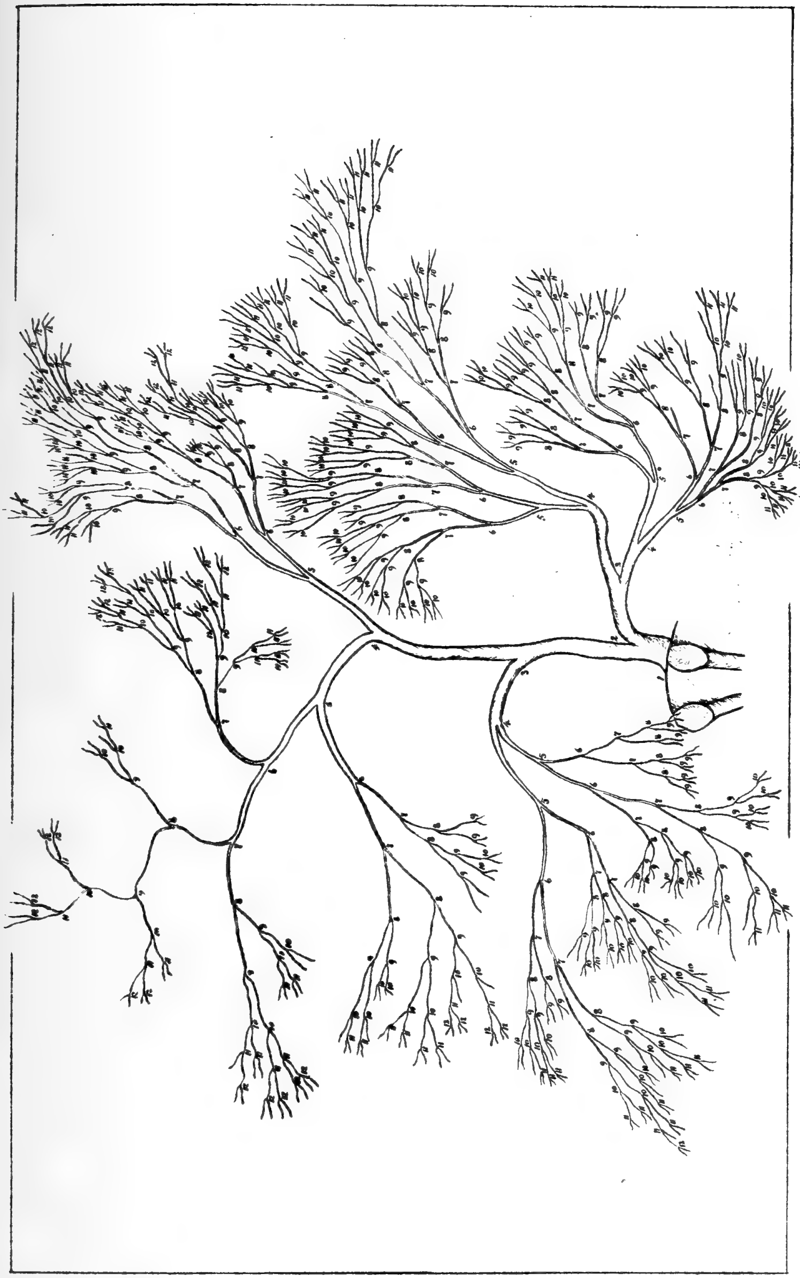
Lyman on Astrophyton.



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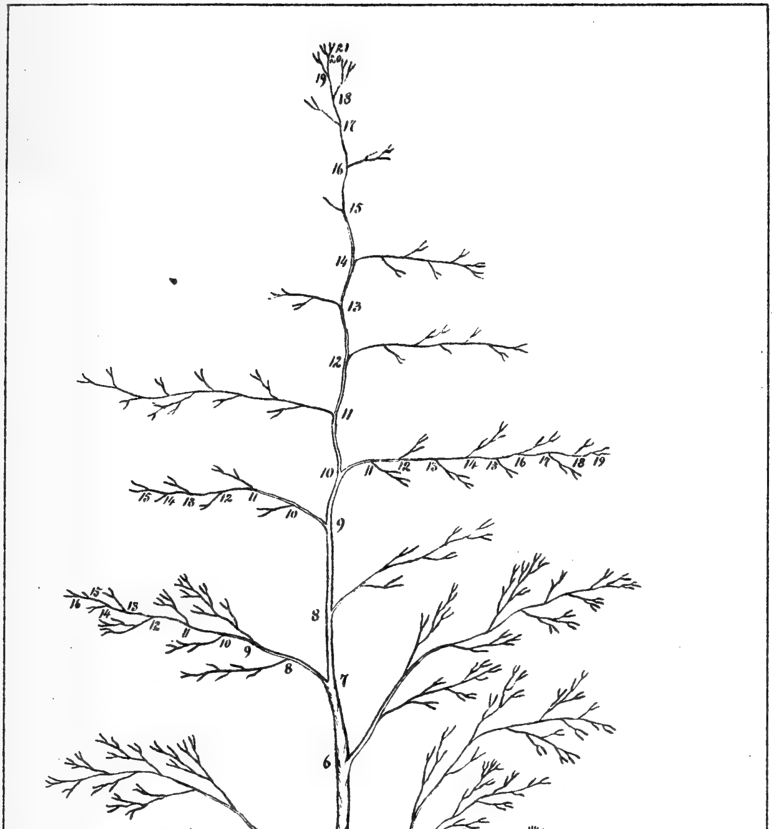

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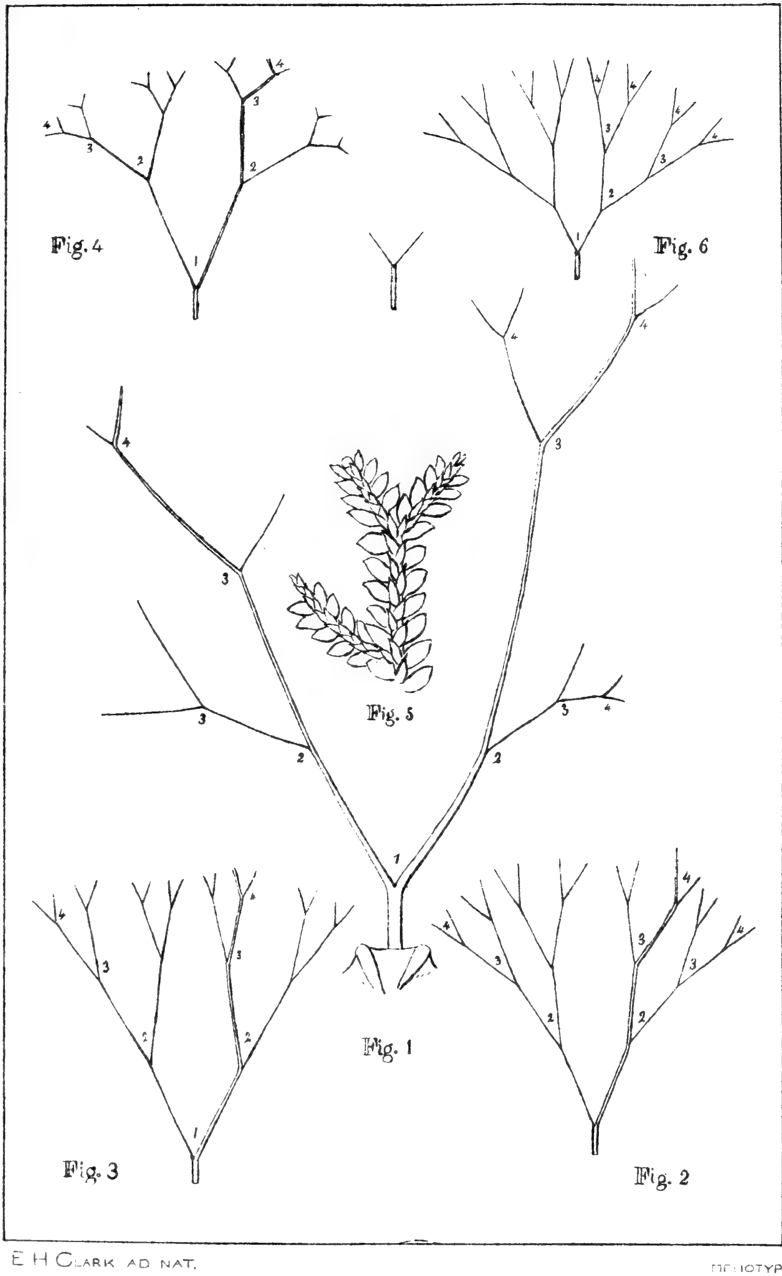
Heliotype

Lyman on Astrophyton



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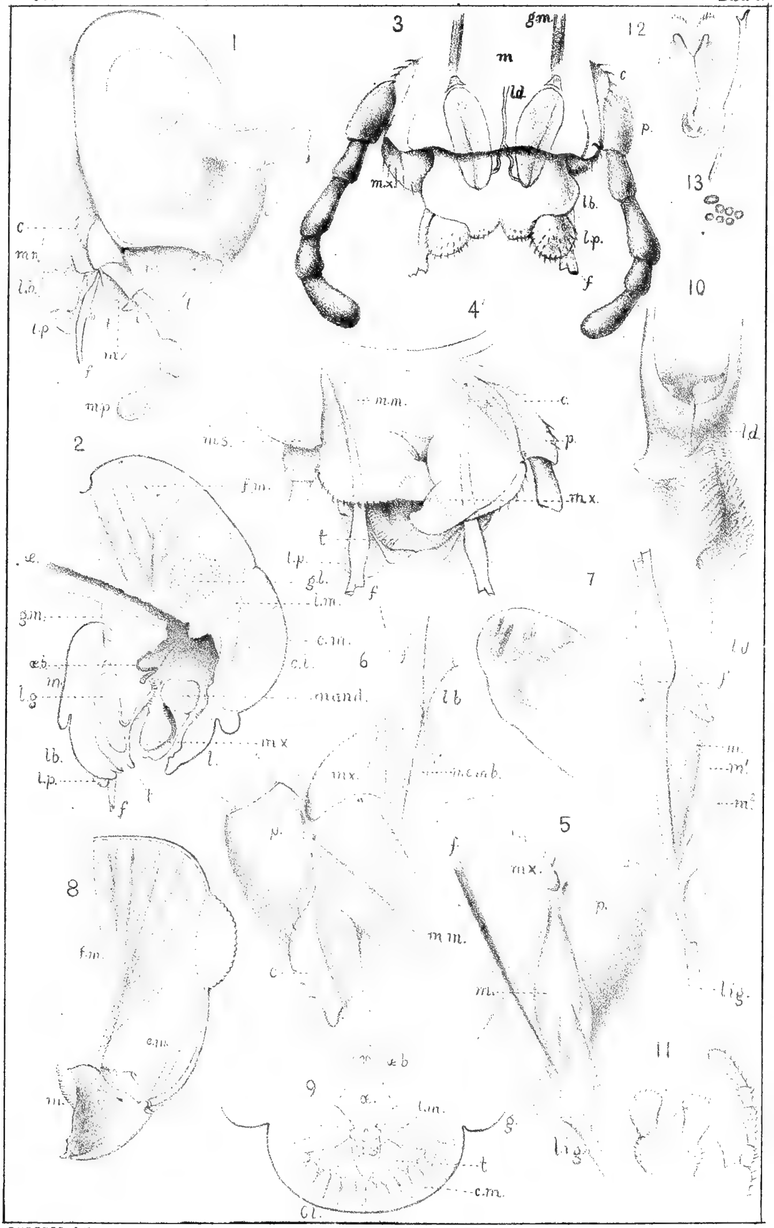
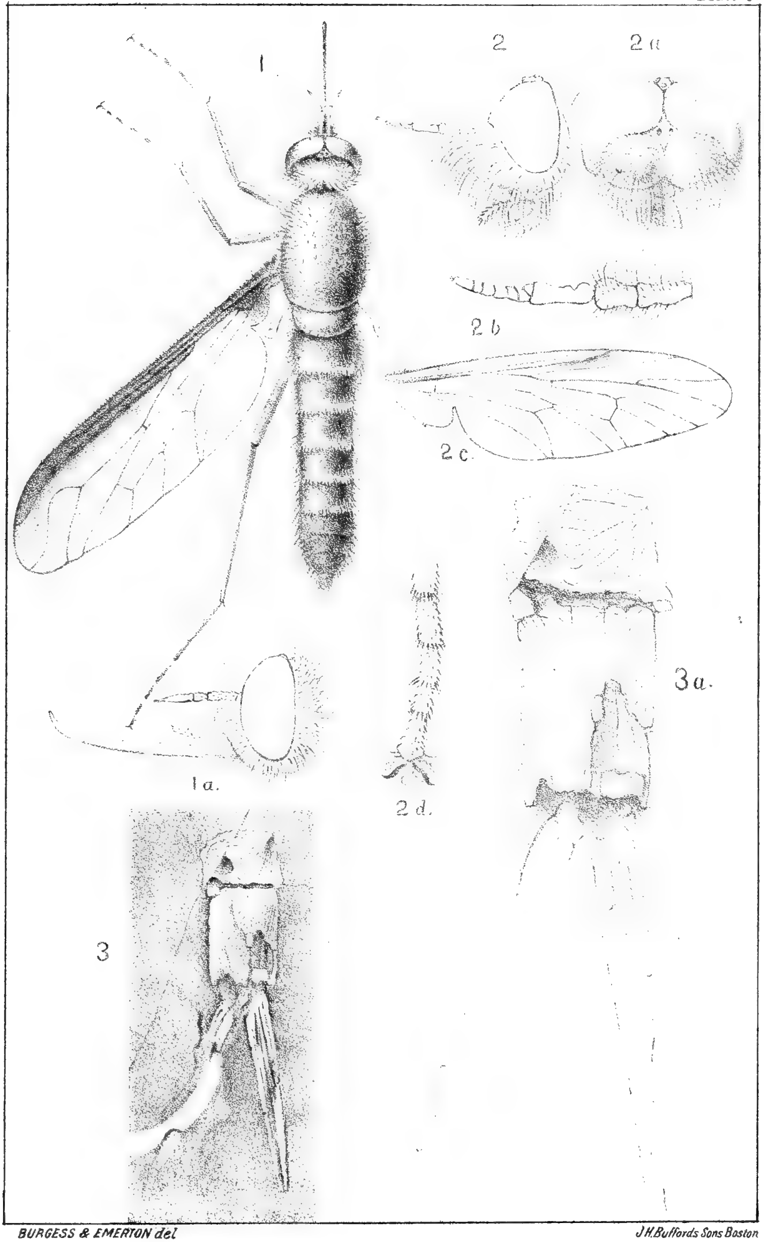


BURGESS del. EMERTON on stone J.H.Buffords Sons Boston

BURGESS, ANATOMY OF PSOCUS.



BURGESS & EMERTON del

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BURGESS, AMERICAN DIPTERA. SCUDDER, ON RHACHURA.