PROCEEDINGS

OF THE

ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

1875.

PUBLICATION COMMITTEE.

Joseph Leidy, M.D., Geo. W. Tryon, Jr.,
Wm. S. Vaux, Edw. J. Nolan, M.D.,
W. S. W. Ruschenberger, M.D.

PHILADELPHIA:
ACADEMY OF NATURAL SCIENCES,
S. W. Corner Nineteenth and Race Streets.
1875.

Hall of the Academy of Natural Sciences,
Philadelphia, March, 1876.

I hereby certify that printed copies of the Proceedings for 1875 have been presented at the meetings of the Academy, as follows:—

Pages 9 to 56	. . . . .	April 20, 1875.
" 57 to 72	. . . . .	" 27, 1875.
" 73 to 104	. . . . .	May 11, 1875.
" 105 to 120	. . . . .	" 18, 1875.
" 121 to 136	. . . . .	June 1, 1875.
" 137 to 152	. . . . .	" 15, 1875.
" 153 to 168	. . . . .	" 29, 1875.
" 169 to 200	. . . . .	July 13, 1875.
" 201 to 216	. . . . .	" 20, 1875.
" 217 to 264	. . . . .	" 27, 1875.
" 265 to 328	. . . . .	August 31, 1875.
" 329 to 344	. . . . .	September 28, 1875.
" 345 to 392	. . . . .	October 19, 1875.
" 393 to 408	. . . . .	November 2, 1875.
" 409 to 424	. . . . .	December 21, 1875.
" 425 to 456	. . . . .	January 11, 1876.
" 457 to 488	. . . . .	February 22, 1876.
" 489 to 520	. . . . .	March 14, 1876.

EDWARD J. NOLAN, M.D.,
Recording Secretary.

PHILADELPHIA:
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LIST OF CONTRIBUTORS,

With reference to the several articles contributed by each.

For Verbal Communications see General Index.

PROCEEDINGS

OF THE

ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

1875.

JANUARY 5, 1875.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-two members present.

The following papers were presented for publication:—

"On the Lingual Dentition and Genitalia of Partula and other Pulmonata." By Wm. G. Binney.

"On the Jaw and Lingual Membrane of North American Terrestrial Pulmonata." By Wm. G. Binney.

On the Transition Beds of the Saskatchewan District.—Prof. COPE communicated the results of an examination of a series of vertebrate fossils collected near the Milk River by George M. Dawson, geologist of the British North American Boundary Commission. These were derived from beds of the Fort Union Epoch, from a horizon one and two hundred feet above the beds of cretaceous No. 5. They embrace eight species of reptiles which are determinable from the specimens, representing the two orders *Dinosauria* and *Testudinata*. The specimens are the following: Dinosauria, *Cionodon stenopsis*, sp. nov.; *?Hadrosaurus*, sp. (with the caudal vertebra slightly opisthocoelian); *Compsemys ?victus*, Leidy; *Compsemys ogmius*, sp. nov.; *Plastomenus coalescens*, sp. nov.; *Plastomenus costatus*, sp. nov.; *Trionyx* ?sp., and *Trionyx vagans*. The species marked with question are represented by such fragments as to forbid final determination, though the name given is probably correct. The Dinosaurian remains are most abundant, including fragments of many parts of the skeletons of several species. The *Cionodon stenopsis* is of about the size of the *C. arctatus*, Cope, but has a much diminished palatine face of the maxillary bone, and the teeth do not present the longitudinal keel on the lower part of the crown seen in the more southern saurian.

The species represent a portion of the fauna of the Fort Union Epoch, as observed in Dakota and Colorado, and the presence of *Dinosauria* demonstrates again its pertinence to the cretaceous period. The genus of tortoises *Compsemys*, Leidy, is peculiar to the Fort Union Epoch, while *Plastomenus*, Cope, belongs to the Eocene. Its presence in this fauna would constitute an important assimilation to the lower tertiary, but the specimens are not complete in some points necessary to a final reference. The species are in any case nearly allied to that genus.

There are, however, gar scales included in the collection, which closely resemble those of the genus *Clastes* of the lower Eocenes of the Rocky Mountains. This is empirically another indication of near connection with tertiary time, but not conclusive, since allied genera have a much earlier origin in mesozoic time. For the present their occurrence in this fauna cannot be regarded as of much weight in comparison with the presence of numerous *Dinosauria*, an order which in every other known portion of the earth perished with the age of ammonites and pterodactyles. Nevertheless the list of species, short as it is, indicates the future discovery of a complete transition from cretaceous to eocene life more clearly than any collection yet obtained marking this horizon in the West.

Mineralogical Notes.—Prof. Persifor Frazer, Jr., explained that in his communication of Dec. 22, 1874, for Diorite he meant Syanite. Prof. Frazer also spoke of some observations recently made by him on a specimen of Chlorite slate in which were found crystals of Oligoclase which were again found upon examination to contain other crystals of Chlorite slate.

JANUARY 12.

The President, Dr. RUSCHENBERGER, in the chair.

Seventeen members present.

The Herpetology of Florida.—Prof. COPE made some remarks on the Batrachians and Reptiles of Florida. He stated that it formed a distinct subdivision of the Austroriparian region (see Gray's Atlas of the United States, 1873, for a review of the Geographical Distribution), the evidence furnished by the lower vertebrates confirming that derived from the higher vertebrata and the plants. There are fifteen species of Batrachia and Reptilia not found in any other part of North America; three of these occur in Cuba, but none elsewhere. He then stated that Mr. Meek had recently sent to the museum of the Smithsonian Institution a species of *Elaps*, the *E. distans* of Kennicott, which had been known previously from the Sonoran region only. This discovery might be associated with that of the western burrowing owl in Florida, and the fact that the Floridan *Ophibolus getulus* presents the same number of rows of scales as the black and white Ophiboli of the Sonoran region.

January 19.

The President, Dr. Ruschenberger, in the chair.

Twenty-four members present.

On a Fungus in a Flamingo.—Prof. Leidy remarked that a pair of Flamingoes had recently died in the Garden of the Zoölogical Society at Fairmount Park. Dr. Chapman, who had dissected the birds, called his attention to the diseased condition of the lungs of one of them, the other not being affected in this respect. The posterior part of the lungs on both sides, contiguous to the abdominal air sacs, was occupied by an indurated brown substance, in striking contrast with the usual bright roseate hue of the neighboring pulmonary tissue. An incision made into the indurated substance exhibited a brown compact surface with greenish-black dots which corresponded with the bronchial tubes. On microscopical examination the substance was found to be pervaded with a fungous vegetation, and the greenish-black dots were due to the fruit heads profusely covered with colored spores.

Prof. Owen, upwards of forty years ago, mentioned the existence of a green mould he had observed in the lungs of a Flamingo, which died in the menagerie of the Zoölogical Society of London, but he gave no description of the plant by which we can recognize it. Since then many accounts have been given of the existence of fungous vegetation in the diseased lungs of various birds, but I think it has not been determined whether the diseased condition was due to the fungus, or whether this was a subsequent production.

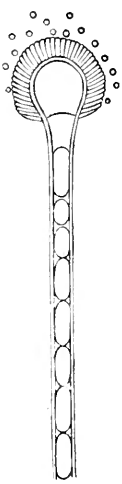
The plant observed in our diseased Flamingo belongs to the Moulds or Mucedines, and is evidently an Aspergillus. A number of species of this genus have been described, growing on various decaying substances. The common Blue Mould found in cheese and bread kept in a damp place, is the *Aspergillus glaucus*. From this the mould of the Flamingo is quite distinct in the structure of the fruiting receptacles, in which respect it more nearly resembles the *Aspergillus dubius*, growing on rabbit's dung. The Aspergillus of the Flamingo, I suspect to be the same as one described by M. Robin, under the name of *Aspergillus nigrescens*, discovered by him in the lungs of a pheasant (*Phasianus colchicus*) affected with phthisis.

In the Flamingo mould, the mycelium consisted of a dense flock of delicate ramifying filaments pervading the indurated pulmonary tissue, which consisted largely of nucleated cell elements and granules. The threads of the mycelium were branching, and occupied on the interior with clear globules appearing like rows of beads. The threads measured usually the $\frac{1}{500}$th of a millimetre or less in diameter.

The fruiting stems (see accompanying figure) were straight, from one-fourth to two-fifths of a millimetre long, not articulated, usually simple, and rarely divided approximating a right angle, near the head. They were about the $\frac{1}{250}$th mm. wide at the mycelial origin and double the width approaching the head. The head continuous with the stem was pyriform; or the stem expanded into a globular receptacle, which was closely crowded with linear processes, or sporophores, supporting the spherical, translucent colored spores. The latter profusely invested the heads, but were too ripe and readily detached to determine their exact arrangement in relation with the sporophores. These, on the contrary, remained firmly attached to the receptacle.

The receptacles measured from the $\frac{1}{60}$th mm. to the $\frac{1}{50}$th mm. The stratum of sporophores was from $\frac{1}{166}$th mm. to the $\frac{1}{125}$th mm. thick. The spores were the $\frac{1}{333}$d mm. in diameter.

By transmitted light, the spores appeared so faintly colored that the tint was undetermined; by reflected light, in mass they appeared of a greenish hue. The receptacles including the sporophores appeared fuscous by transmitted light, but white by reflected light.



336 diam.

In M. Robins' plate of *A. nigrescens* he represents most of the fruiting stems as articulated, but in our plant none of this character were detected.

JANUARY 26.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-one members present.

The resignation of Lloyd P. Smith as a member of the Academy, was read and accepted.

The following were elected members:—

J. M. Patterson, Chas. A. Young, Dr. Alex. Muckle, Hugh J. Fagan, Nicholas Lennig, and Wm. V. McKean.

The following standing committees were elected for the year 1875:—

ANTHROPOLOGY.
J. Aitken Meigs,
Henry S. Schell,
J. F. Richardson,
Edw. Goldsmith,
H. C. Chapman.

COMPARATIVE ANATOMY.
Harrison Allen,
J. H. McQuillan,
Jos. Leidy,
H. C. Chapman,
R. S. Kenderdine.

ORNITHOLOGY.
Edwin Sheppard,
Jas. A. Ogden,
Wm. G. Freedly,
Richard K. Betts,
Sarah P. Monks.

ARTICULATA.
Geo. H. Horn,
R. S. Kenderdine,
T. Hale Streets,
John L. LeConte,
H. C. Chapman.

BOTANY.
Thomas Meehan,
Isaac Burke,
J. H. Redfield,
R. S. Kenderdine,
Rachel Bodley.

MAMMALOGY.
Harrison Allen,
Edw. D. Cope,
H. C. Chapman,
U. Smith,
Horatio C. Wood, Jr.

RADIATA.
Geo. H. Horn,
J. Hunt,
R. S. Kenderdine,
Samuel B. Howell,
Bernard A. Hoopes.

STRATIGRAPHIC GEOLOGY.
J. P. Lesley,
F. V. Hayden,
Franklin Platt,
Persifor Frazer, Jr.,
Clarence S. Bement.

VERTEBRATE PALÆONTOLOGY.
Jos. Leidy,
Edw. D. Cope,
Harrison Allen,
Wm. H. Dougherty,
Persifor Frazer, Jr.

MINERALOGY.
Wm. S. Vaux,
Edw. Goldsmith,
Jos. Wilcox,
Clarence S. Bement
Persifor Frazer, Jr.

PHYSICS.
Robert E. Rogers,
J. G. Hunt,
Robt. Bridges,
J. H. McQuillan,
Alex. Wilcocks.

INVERTEBRATE PALÆONTOLOGY.
T. A. Conrad,
Horatio C. Wood, Jr.,
Persifor Frazer, Jr.,
Geo. A. Konig,
Edw. D. Cope.

Ichthyology.
Edw. D. Cope,
Thaddeus Norris,
J. H. Redfield,
Chas. F. Parker,
A. G. Reed.

Herpetology.
Edw. D. Cope,
Harrison Allen,
Samuel B. Howell,
Chas. F. Parker,
J. Wilson.

Chemistry.
F. A. Genth,
Robt. Bridges,
Edw. Goldsmith,
Samuel B. Howell,
Rachel Bodley.

Instruction and Lectures.
Hector Tyndale,
J. Aitken Meigs,
W. S. W. Ruschenberger,
Howard N. Potts,
Aubrey H. Smith.

Library.
Jos. Leidy,
Chas. F. Parker,
Geo. W. Tryon, Jr.,
W. S. W. Ruschenberger,
J. G. Richardson.

February 2.

The President, Dr. Ruschenberger, in the chair.

Twenty-eight members present.

The following papers were presented for publication:—

"Curious Anomaly in the History of Certain Larvæ of Acronycta Oblinita, Guenée." By Thomas G. Gentry.

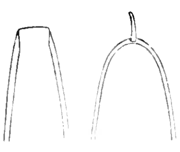
"Notes on the Noctuidæ, with Descriptions of Certain New Species." By H. R. Morrison, Cambridge, Mass.

Notes on some Parasitic Worms.—Prof. Leidy remarked that Mr. Henry Horn, assistant superintendent at the Zoölogical Garden, had given to him several specimens of worms, recently passed by a Bengal tiger. There are three males and eight females, and they appear to be the *Ascaris mystax*, which has been found in many other feline species, including the domestic cat and the lion. The characters of the worms from the tiger are as follows: Body almost equally tapering towards the extremities. *Female*—Cephalic end inflexed, with long narrow semi-lanceolate alæ. Caudal end straight; tail short, conical, subacute. *Male*—Cephalic end straight, alated. Caudal end inflexed, and furnished with a row of about two dozen minute round papillæ on each side ventrally; tail short, conical, acuminate. Length of females from

2 to $3\frac{1}{4}$ inches; thickness from $\frac{1}{4}$ to $\frac{1}{2}$ line. Length of males from 13 to 16 lines; thickness from $\frac{1}{6}$ to $\frac{1}{5}$ line.

Prof. Leidy further remarked that Mr. Thomas Meehan had submitted to his examination some worms which had been found in an apple. They consisted of one entire individual and the anterior half of a second, and apparently pertain to the *Mermis acuminata*, a long thread-worm which has been discovered infesting the larvæ of many insects. Among others it is parasitic in the larva of the codling-moth, or fruit-moth of the apple, which readily accounts for its presence in the fruit. Twenty-five years ago (Proc. 1850, 117) he had described a worm, belonging to the collection of the Academy, and labelled as having been obtained from a child's mouth, which was evidently the same species. It having been in a child's mouth is probably to be explained by supposing that the child had eaten an infected apple.

Fig. 1.

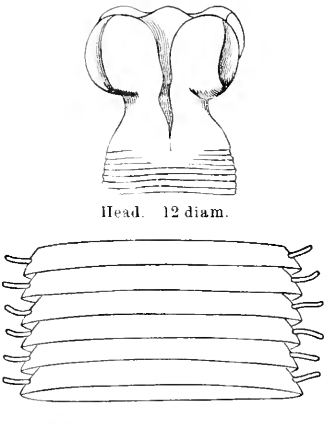


Head. Tail.
40 diam.

The characters of the present specimens of the worm, both females, are as follows: Body filiform, pale fuscous, narrower anteriorly. Head conical, truncate, with the mouth simple and unarmed. Caudal extremity thicker than the head, obtusely rounded, and furnished with a minute spur-like process. Length 5 inches 8 lines; cephalic end at mouth $\frac{1}{12}$ mm.; a short distance below $\frac{1}{5}$ mm.; middle of body $\frac{3}{8}$ mm.; near caudal end $\frac{1}{4}$ mm.; mucro $\frac{1}{12}$ mm. long, $\frac{1}{80}$ mm. thick.

From an Australian wombat, which recently died at the Zoölogical Garden, Prof. Leidy had obtained from the stomach two specimens of a tapeworm of the genus Taenia. They are three inches long, and about four lines broad at the last joint. The characters are as follows: Entire worm elongated and compressed pyramidal. Head quadrate, narrowing below, convex above, furnished laterally with four prominent hemispherical bothria. Neck short, constricted. Segments of the body very short and wide, campanulate with the projecting points giving the body laterally a serrate appearance. From the intermediate joints a narrow conical papilla protruded from each side of the same joint, but none could be made to protrude from the back joints, from which globular white ova were expressed measuring 0.052 mm. diameter. Head $\frac{3}{4}$ of a line in

Fig. 2.



Head. 12 diam.

Segments 1 inch from head. 9 diam.

breadth. One inch from the head six segments occupied the space of a line; at the posterior part of the body four segments occupied the same extent. The species appears not to have been previously described, and may, therefore, be named TAENIA BIPAPILLOSA.

The Extinct Batrachia of Ohio.—Prof. COPE stated that the explorations of the coal measures in eastern Ohio conducted during the past season by Prof. Newberry, State Geologist, had increased the number of species of extinct Batrachians to thirty-three. A new genus and species were described under the name of *Pleuroptyx clavatus*, which is remarkable for the structure of its ribs. Each of these presents a wide thin ala on its posterior face, which is abruptly discontinued below. The shaft of the rib is short and enlarged distally, where it is hollow and truncate. The vertebræ are as large as those of the anaconda, and there is no ventral armature preserved. Another genus exhibits two strata of chevrons in an armature of ventral rods, the angle of the upper having an opposite direction to that of the lower. The gular scuta are smooth. It was named *Hyphasma lævis*. An interesting addition to the fauna was stated to be a new species of the horned genus *Ceraterpeton*, Huxl. The head is relatively large, and covered with recticulate ridges separated by rows of impressed dots. Horns long, stout, and incurved. It was called *C. punctolineatum*.

Prof. PERSIFOR FRAZER, Jr., exhibited a combination of the polarizer, vertical lantern, and microscope, by means of which the manner in which different salts crystallized out of their solutions, together with the manner in which they affect polarized light, was explained and illustrated by solutions of potassium chlorate and urea in alcohol. The light from a lime lantern is passed through the elbow-tube polarizer, thence upward through the vertical lantern and the two-inch lens microscope, when it is again reflected horizontally on the screen. After the formation of the crystals had been shown by plain polarized light, the analyzer was inserted and the characteristic colors of polarization produced. It was explained that while this method had the advantage of so magnifying the crystals produced from small quantities of solutions that their structure could be minutely observed, as well as the sudden molecular change which caused the polarizing effect, it was open to the objection of a very large loss of light—first, by the polarizer, and again by the microscope. It was suggested that a means of obviating at least a part of this difficulty would be the use of the parabolic reflector, in connection with the first condenser.

Prof. Frazer then proceeded to exhibit the microscopic structure of thin sections of some of the Palæozoic rocks found in York and Adams Counties, Pa. A map of the region whence the specimens were collected was first thrown on the screen and the geological formations described. After explaining the manner in which the thin sections were prepared, the following specimens were exhibited: A piece of Diorite from the northeastern corner of Saxony, a foliated chlorite slate, ferruginous gneiss. Nes'silicon steel ore, Diorite, quartzite rock with magnetic iron ore from the northeastern part of York County, hornblende slate, limestone containing particles of a substance probably apatite, a syenite from Germany, with hornblende, quartz, and orthoclase, and a syenite from near Gettysburg. The gizzard of a cockroach was also exhibited and shown to produce beautiful colors in polarized light.

FEBRUARY 9.

The President, Dr. RUSCHENBERGER, in the chair.

Nineteen members present.

Notes on some Parasitic Worms.—Prof. LEIDY exhibited some nematoid worms, on which he made the following remarks:—

One of the species is common in feline animals, and is the *Ascaris mystax.* The specimens, consisting of fifteen females and five males, had been sent to Dr. Chapman, by Mr. Thompson, Superintendent of the Zoological Garden, who reports that they had been passed by the American wild-cat. The females measure from $2\frac{1}{2}$ to 4 inches in length, by $\frac{2}{5}$ to $\frac{2}{3}$ of a line in thickness. The males measure from $2\frac{1}{4}$ to $2\frac{1}{2}$ inches in length, by $\frac{1}{3}$ to $\frac{1}{2}$ a line in thickness. The specimens are larger, and the alæ of the head proportionally better developed, and therefore more conspicuous than in those noticed at the previous meeting as having been passed by the Bengal tiger. The worms of the tiger are such as have been described under the name of *Ascaris leptotera*, which appears to be only a variety of *A. mystax.*

The other worm is a *Filaria*, apparently an undescribed species. Half a dozen individuals of the two sexes were obtained from the peritoneal cavity of an Australian Whallabee, which recently died in the garden of the Zoological Society. The characters of the parasite are as follow:—

Filaria spelæa.—Body filiform, translucent whitish, tapering at the extremities. Cephalic end straight, obtusely rounded, furnished with four equidistant papillæ around the mouth. Caudal end narrowest, rather abruptly attenuated, and spirally rolled once or twice, and terminating obtusely. A distinct anal aperture observable in the female. A row of eight papillæ on each side ventrally of the caudal end of the male; three in advance and the others back of the genital aperture. Penis a long, tubular style, thick at the upper part, narrow and curved below. Accessory piece a short, thick, curved tube, widening at the upper end in a spade-like, furcate portion.

Œsophagus long, cylindrical, as wide as the succeeding intestine.

Measurements: Female, length 10 inches, thickness $\frac{1}{4}$th line. Length of tail from anal aperture $\frac{2}{8}$ths mm. Male, length 4 to $4\frac{1}{2}$ inches; thickness $\frac{1}{66}$th inch. Tail, from genital aperture, forms $\frac{2}{3}$ of a circle $\frac{1}{2}$ a mm. in diameter. Penis $\frac{7}{8}$ths mm. long; accessory piece $\frac{1}{5}$th mm. long.

On Increase of Power in Plants to Resist Cold.—Mr. THOMAS MEEHAN referred to a tuber of *Solanum Fendleri*, exhibited by him some months ago, and which had taken a departure towards those of the common potato. He had offered some suggestions in relation to the possibility of a common origin of these two species; but among the improbabilities he had classed the power of resisting cold; as, while the common potato was easily destroyed by frost, Fendler's potato endured without injury a temperature of zero. He had been under the impression that whatever change plants might experience in the course of ages, the adaptation to special temperatures was nearly if not quite unchangeable.

A recent experience, however, suggested the possibility of more change than he had supposed. During the very low temperature, with the high wind of a few weeks ago, the frost to the extent of two degrees or so, and for a short time, got into a green-house with blooming plants, some of which were injured by it. Among these were *Calla*, *C. Æthiopica*, *Browallia elata*, *Bouvardias*, *Begonias*, and some others. The light frost, in the case of all but the first named, destroyed the leaves, but left the flowers uninjured. The flowers in their several parts are but metamorphosed leaves, and thus we see that with the morphological advance of the leaf to a petal came an increased physiological power to endure cold. In the case of the *Calla*, the flowers as well as the leaves were destroyed, illustrating the same law, as the spathe of this flower is but a leaf very slightly changed, and consequently more subject to the laws regulating leaf life.

There was nothing quite new in these observations, as all must remember that when the first light frost kills the *Dahlias*, *Chrysanthemums*, and other tender plants, the petals would often remain uninjured after the leaves had been blackened by frost; and also the fact that when the leaves of plants became still more highly metamorphosed, and became seeds, those of the tenderest plants would often endure considerable cold. Thus the seeds of the common *Convolvulus* or morning glory, and of the *Balsam* or lady's slipper, as it is called in American gardens, would live out in the earth in our severe climate and grow in the spring, though the plants would be killed by a single degree of frost.

The subject was attracting some attention just now through a paper of Professor De Candolle, abstracts of which were now going through scientific serials, in which he is made to say that in the many changes which species have encountered through the course of ages, the peculiar adaptation to special temperatures has been among the least changeable of characters. Of course what are known as theories of evolution hardly find a parallel in the cases he had referred to. Evolution deals with the modification of organs. It is still the same organ though changed in form. The modified leaf is still a leaf, though it may be contended to be specifically distinct from its parent. In the cases he brought forward it was an absolute change of one organ to another organ. Yet he thought it was impossible to conceive of evolutionary movements wholly independent of morphological laws. However, he offered the facts for whatever they might be worth, and the suggestions on them only as leading to thought on the greater question.

On Green-Sand Vertebrata.—Prof. COPE made some observations on the vertebrates of the New Jersey cretaceous, and described the characteristics of several species of gavials. The genus *Hyposaurus* possesses a sagittal crest. The *H. fracterculus*, Cope, is the smallest of the species, and must be referred to the genus *Gavialis*. The chimæroid fishes are very abundant, about twenty species being included in a monograph of them now in course of publication. They belong to the genera *Leptomylus*, Cope, *Diphrissa*, Cope (type *Ischyodus solidulus*), *Ischyodus*, Egyt., and others. *Leptomylus forfex*, and numerous other species were described for the first time.

Effects of Cold on Iron.—Mr. WILLARD referred to two instances of the brittleness of iron under the prevailing low temperatures which he noticed yesterday. In breaking up an old locomotive, the cutting off of the rivet heads, which usually requires heavy sledging, was effected by a single blow, as if they were made of cast iron. In the forging of a long steamboat shaft of the best hammered iron which hung balanced in a crane, the hammering of the heated end caused vibration in the overhung end—harmless in ordinary temperatures, but at 10° F. sufficient to cause the beam to break sharp near the point of support. The published tests of iron and steel show no loss of tensile strength at low temperatures under a gradual stress, but all experience shows great loss of *body*, or ability to resist a blow.

FEBRUARY 16.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-eight members present.

Mr. Henszey announced that Mr. Isaiah V. Williamson had given to the Academy ground-rents to the amount of $25,000, the interest of which is to be applied to the purchase of books for the library, and offered the following preamble and resolutions, which were unanimously adopted:—

WHEREAS, Our esteemed friend, Isaiah V. Williamson, having made a donation to the Academy of Natural Sciences of Philadelphia of the principal sum of Twenty-five Thousand and Eight Dollars $\frac{40}{100}$ (in ground-rent securities) as a permanent fund for the increase of the Library, it is proper that a suitable acknowledgment should be made; therefore,

Resolved, That the liberal donation made by Isaiah V. Williamson, Esq., of Twenty-five Thousand and Eight Dollars $\frac{40}{100}$, as a permanent fund for the use of the library, is of the greatest value in the promotion of science, thereby enabling students of the Academy to pursue their investigations with knowledge of all the information of the age, and that the Society therefore tender to him its most cordial thanks.

That this fund be named the I. V. Williamson Fund, and that the committee on the library be directed to prepare a suitable book-plate to include a record of the amount and date of acceptance of the gift, to mark every volume acquired through the I. V. Williamson Library Fund, so that students may know to whom they are indebted for such indispensable aid.

That the library committee be requested to obtain a portrait of Mr. I. V. Williamson and place it in the library among those of the distinguished philanthropists who have been benefactors of the Academy.

That a copy of the above preamble and resolutions, signed by the officers of the Society, be transmitted to Isaiah V. Williamson, Esq.

On motion of Prof. Frazer it was

Resolved, That a committee be appointed by the President which shall seek the co-operation of such scientific men throughout the country as it shall see proper to invite to join them in an effort to have a collection of ores, newer and rarer minerals, and other objects of natural history of the country at the coming Centennial exhibition.

On the Homologies of the Sectorial Tooth of Carnivora.—Prof. COPE made the following remarks on the probable origin of the sectorial tooth.

The series of dental types which precede the complex structures of teeth presented by the most specialized divisions of the hoofed mammalia, have been pointed out by the writer in an essay On the Origin and Homologies of the Types of Dentition of the Mammalia Educabilia.[1] From this discussion the analysis of the most specialized sectorial tooth of the carnivora, as seen in the Felidæ, was omitted. As light has been thrown on the subject by later researches, a note of the conclusions will be made here, chiefly with reference to the dentition of the lower jaw.

In the above essay I regarded the simple four-lobed or quadrituberculate molar of the hypothetical *Bunotherium* as the starting point of all more specialized forms of crested teeth. The second and third lower molars of the peccaries (*Dicotyles*) represent such a type. It was also pointed out that additional tubercles may be added to this, or to a still simpler form, by the development of basal cingula.

The genus *Hyopsodus* presents a modified form of quadrituberculate molar; in the genera *Pantolestes* and *Antiacodon* we observe that the tubercles are similar, excepting that the anterior inner is slightly bifid. In *Pelycodus* (whose systematic position is uncertain) the two apices of this tubercle are separated more widely from each other, so as to constitute two cusps. These are connected with the anterior outer cusp by acute ridges which thus form two sides of a triangular area; the anterior ridge is evidently a developed cingulum.

The tubercular molar of some *Viverridæ*, and among extinct forms especially of the *Didymictis protenus*, Cope, presents a similar structure to that just described. This furnishes a ready explanation of the tooth immediately in advance, which is the primitive form of sectorial tooth characteristic of that type of carnivora. The three anterior tubercles are largely developed, standing at opposite angles of a triangular space; the outer and anterior cusps are the most elevated, and the ridge which connects them is now a short cutting blade. The posterior portion of the tooth does not share in this elevation, and its two tubercles are in some genera replaced by an elevation of one margin which leans obliquely towards the middle of the crown. In *Mesonyx* this is represented by a median longitudinal crest. If the two tubercles of the posterior part of this tooth (which may be termed a *tubercular sectorial*) are elevated and acute, we have the molar of many recent and extinct *Insectivora;* if the same portion, now called a *heel*, is much reduced, we have the type of *Oxyæna* and *Stypolophus*. In the *Canidæ* the three anterior tubercles are much less elevated than in the genera above named; the external is much the larger, and the anterior removed further forwards so as to give the blade a greater antero-posterior extent. The heel is larger and without prominent tubercles. In the *Mustelidæ* the inner of the two median cusps is often reduced to a rudiment, or is entirely wanting,

[1] Journal of the Academy of Natural Sciences of Philadelphia, 1874.

and the heel is large. The lower sectorial of the *Hyænidæ* has no inner tubercle, and the heel is much reduced. In some of the sabre-toothed tigers, the heel remains as a mere rudiment, while in the true cats it has entirely disappeared, and the carnassial tooth remains perfected by subtraction of parts as a blade connecting two subequal cusps. The *Hyænodontidæ*, as is known, possess three carnassial teeth without inner tubercles. The history of this form is as yet uncertain, as it was evidently not derived from contemporary forms of the Eocene with tubercular sectorials.

The development of the carnassial dentition has thus been accomplished, first by an addition of anterior cusp, and subsequently by the subtraction of the inner and posterior cusps, so that of the original four of the quadritubercülate molar but a *single one*, *i. e.*, the anterior external, remains. The same process may be observed in the successional modifications of the entire dentition of the jaws. The Eocene forms of Carnivora frequently display more numerous sectorial teeth (such as they are) than any of the existing families. The important change which is clearly indicated is the progressive extinction of the genera with numerous sectorial teeth, accompanying the increasing specialization of the sectorial tooth in the genera which remain. In other words, the numerous types of digitigrade carnivora which have survived, are those developing but one sectorial tooth (whose earliest representative is Didymictis). The increased perfection of the sectorial has been associated with a reduction in the number of other molars, first posterior, then anterior to it, which reduction has been accompanied by an increased relative size of the sectorial. By this process concentration of the carnassial function has been gained, and increased robustness of the jaws, by progressive shortening. The slender form of the rami of the Eocene genera and *Hyænodon*, are much less efficient in functional use than the stout jaws of existing *Mustelidæ*, *Hyænidæ*, and *Felidæ*.

A second point in the history of the Eocene Carnivora remains to be considered. In all of the genera which I have had the opportunity of examining, excepting *Mesonyx*, namely, *Ambloctonus*, *Oxyæna*, *Prototomus*, and *Didymictis*, the tibio-astragalar articulation is of a primitive character. The astragalus is flat, and the applied surfaces are nearly plane, and without the pulley-shaped character seen in existing Carnivora, as dogs, cats, and, in a less degree, in the bears, and in other Mammalia with specialized extremities, as *Perissodactyla*, *Artiodactyla*, etc. The simplicity of structure resembles, on the other hand, that found in the opossum, and various *Insectivora*, *Rodentia*, and *Quadrumana*, and in the *Proboscidia*, most of which have the generalized type of feet. The structure indicates that the carnivorous genera named were plantigrade, a conclusion which is in conformity with the belief, already expressed, that the Mammalia of the Eocene exhibit much less marked ordinal distinction than do those of the Miocene and the recent periods. It is indeed questionable whether some of the genera here included in the *Carnivora* are not gigantic *Insectivora*, since the tibio-tarsal articulation in many, the separation of the scaphoid and lunar bones in *Synoplotherium*, the form of the molars, and the absence of incisor teeth in some, are all characteristic of the latter rather than the former order.

FEBRUARY 23.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-four members present.

Dr. Geo. H. Horn was elected a member of the Council, to fill the vacancy created by the resignation of Dr. LeConte.

J. Towers Pennypacker, Peter F. Rothermel, and Charles E. Hall were elected members.

The Committees to which they had been referred recommended the following papers to be published :—

CURIOUS ANOMALY IN HISTORY OF CERTAIN LARVÆ OF ACRONYCTA OBLINITA, GUENEE, AND HINTS ON PHYLOGENY OF LEPIDOPTERA.

BY THOMAS G. GENTRY.

In the autumn of 1873, numerous larvæ of *Acronycta oblinita* were observed by the writer feeding upon the leaves of *Polygonum Pennsylvanicum*. Their ravages were confined to a limited region, in which a plentiful supply of their favorite food was found to meet the most vigorous demands. Within a space of fifty feet square, more than a hundred were counted. A diligent search through the adjoining country failed to reveal any further traces of them. As this species of weed is particularly prolific in Germantown, I had hoped to meet with other larvæ of the same species. Instances have occurred in the writer's experience, and doubtless in the experience of others, of comparatively small scopes of country yielding ample nourishment to hosts of larvæ of a particular species. This is usually noticeable among lepidoptera, which instinctively deposit their ova either in single clusters, or in small collections but slightly isolated from each other. *Vanessa antiopa* affords a familiar illustration of the foregoing assertion.

During the summer of 1867, I daily observed in a grove of red maples a desperate encounter which a score of *Calosoma scrutator* was waging against the harmless, though terrible-looking caterpillars of *Vanessa antiopa*. Although the destruction was on a singularly grand scale, yet hundreds of larvæ remained to undergo their transformations during the latter part of August. The eaves of the buildings in close proximity, fence rails, and in short nearly every available place, were hung with the angular chrysalides. So numerous were the latter, that after the final metamorphoses had passed, the red fluid which was ejected by the tender and newly-formed butterflies, gave everything the appearance of having been profusely spattered with blood.

The area subjected to the desolating influence of these larvæ, did not cover less than two acres of ground. It is worthy of remark, that during the same summer this section of country was unfortunately visited by legions of *Cicada septemdecim*.

It is but occasionally in many years that unusual numbers of a particular species make their appearance in the same locality. A combination of circumstances exists to impose an effectual check upon the undue multiplication of insect life, where nature is not interfered with by man's devices. There are without doubt, in the case referred to, assignable causes for such an undue increase.

Coming back from this digression, the larvæ of *Acronycta* continued to feed during the entire month of October before entering into the pupa state. As a matter of convenience, many were taken home by the writer, placed within a *vivarium*, and fed indiscriminately upon the leaves of various species of *Polygonum*, with remarkable success.

During the latter part of the feeding-time, there being a scarcity of food plants in the immediate neighborhood in which he resided, the thermometer indicating a rather low degree of temperature, his charges were uncared for, and permitted to ramble about their cage for days without suitable and wholesome nourishment. In this predicament many passed into pupæ.

It is well known that the larva of this species constructs a slightly spindle-shaped cocoon. To constitute a framework for this essential covering, it places itself upon a small branch where there is an abundance of leaves at convenient distances which it unites by a perfect network of fibres, stretching from leaf to leaf, or from stalk to leaves, lengthening and shortening as necessity demands, until the desired configuration is assumed. Within this structure, after the lapse of a definite period, it passes into a chrysalis.

Being a spinner of silk, this *Noctuid* approximates very closely a *Bombycid*, the numerous members of whose family, with comparatively few exceptions, are cocoon-builders. So intimately related to this family is the genus *Acronycta*, that it has been retained in the tribe *Bombycoides* of Hübner. So important is the habit of cocoon-manufacture, that it constitutes one of the chief points of distinction between Nocturnal and Diurnal Lepidoptera. For a species that has been proverbial for cocoon-making, any marked deviation from what has been ordinarily observed, would excite no little surprise, and, doubtless, would be accepted by some who are slaves to their prejudices, with considerable hesitation.

While the majority of my larvæ of *Acronycta* passed through their transformations in the normal manner, at least three without the slightest attempt at cocoon-making, like the larva of *Thyreus*

Abbottii, lay upon the surface of the soil, and after a period of five days entered the chrysalis form. By comparison with chrysalides which had been divested of their silken coverings, I could not discern more than ordinary variation. These chrysalides developed into male moths.

That differences occur in the size, shape, and color of cocoons, I am convinced beyond a doubt. The surroundings of a larva and the quantity of its food, have much to do with the size and configuration of its cocoon; while the character and quality of the food affect the color of the same.

Where the molecules of matter that enter into the physical composition of a leaf maintain a nearly perfect stability, by undergoing few or no re-arrangements, the characteristic color will be reflected. Various circumstances, such as the existence of an acid, tend to bring about these molecular re-arrangements. The puncture of a leaf by a *Cynip*, and the want of healthy action therein by inability to decompose the carbonic acid of the atmosphere, are producing causes.

We are all familiar with the changes which leaves undergo in the autumn consequent upon the diminished flow of sap into their petioles, and the somewhat lessened vigor of the sun, that source of life and light, passing from green to black through the transitional tints of yellow, orange, red, and brown.

If the colors of leaves are determined in a measure by molecular arrangements, why may not the introduction of certain kinds of food into an insect's economy, materially different from what it has been accustomed to, so impress with change the organs whose functional business it is to elaborate the fluid which it utilizes in the manufacture of its cocoon as to reflect different colors or shades of colors? I can see no difficulty in the matter. Indeed, it has been shown that if the mulberry silkworm, *Bombyx mori*, be fed upon its natural food for a limited period, and then upon the leaves of different plant-species, it will elaborate a thread dissimilar in color to what is ordinarily produced. To the success of this experiment it is not absolutely essential that the larva should be fed upon its natural food primarily as asserted, as some late experiments of mine testify.

Where the essential conditions are present, such as abundance of leaves of natural food-plant, and a freedom upon the part of the insect to carry out its natural instincts, the cocoon of the same species varies but little, if at all, from the characteristic type.

It is well known that birds vary their styles of architecture in correspondence with changes in their *environment.* What just reason can be adduced for non-variation in the cocoon-making of silk-spinners? Primitively, when the natural sequence of events was not disarranged by the devices of man, a remarkable degree of uniformity, doubtless, prevailed in *nidification* among individuals of the same species; but, latterly, with some exceptions, however, varieties do occur which betray such marked deviations from ordinary types that to the most experienced and critical eye they seem stamped with a newness of design truly astonishing. In the absence of positive evidence *per contra*, they might, with some show of reason, be attributed to the workmanship of essentially different species of unknown habits.

Sticklers for the doctrine of never-varying instinct as determining and controlling the actions of the feathered creation in opposition to intelligent reason, would easily persuade themselves, no doubt, that perceptible differences did not occur, and would argue that the same species manufactured the identical style of nest in these latter times as in the beginning, in the face of the strongest array of evidence.

Instances of variation have been recorded in ornithological literature. The writer has noticed in the Proceedings of the Philadelphia Academy of Natural Sciences, a remarkable deviation fron the typical nest in the case of *Sayornis fuscus*, Baird, so striking and marked as to elicit considerable astonishment, but based upon the most satisfactory and positive evidence.

If changes be introduced into the *environment* of a species of *avis*, by the arts of civilized life or otherwise, sufficiently potent to impress its *sensorium*, so as necessarily to lead to changes of habit whereby a continuance of the species is provided for, and the existing harmony of a moiety of creation remains undisturbed, the argument is irresistible, that, in localities where the food-plant or plants of a larva have disappeared through human civilization, or defeat in the plant's "struggle for existence," being supplanted by another better adapted to the new conditions of life, the insect itself will either succumb or adapt itself to the altered phase of affairs.

Such facts as this hypothetical case presupposes, have fallen under my notice. *Eacles imperialis*, Hübner, was, a few years ago, always to be looked for upon coniferous plants. During the last three years but few individuals have been observed upon plants of this family; for every one feeding thereon, scores have been taken from *Acer rubrum* and *A. saccharinum*; occasionally from the English walnut, *Juglans regia*. *Citheronia regalis*, Fabr., upon *Acer rubrum*. *Platysamia cecropia* upon *Ribes rubrum*, *Acer rubrum*, *A. saccharinum*, and *Pyrus malus*. Other examples might be cited, but enough have been adduced for the writer's purposes. In the cases of *regalis* and *imperialis*, alterations in larval structure have occurred, as diminution in size, smaller development of spiniferous tubercles, color variations to a limited degree; and in case of *imperialis* particularly, comparative smoothness of body, very *few hairs being noticeable*. Still further changes have been observed. It is stated in books that many larvæ which enter the ground preparatory to assuming the chrysalis form, ordinarily construct earthen cells which they line with a thin layer of silk, and subsequently coat with a varnish-like secretion, to render them impervious to water. That this is only occasionally so, I am satisfied from years of experience. That *regalis* and *imperialis* enter the ground is the common experience of lepidopterists; but it is not necessarily so. In many instances, I have witnessed the change effected near the surface of the soil, within a slight cavity which the larvæ by their motions had created, and with considerable portions of the upper surfaces exposed. Again, the change has occurred upon the surface of the soil, without even the slightest attempt at cell-making being manifested. It is necessary to state in connection herewith, that the larvæ were amply provided with earth of the proper consistency, so there could not have been, as far as could be discerned, any obstacle to the fulfilment of their usual habit. *Thyreus Abbottii* in the chrysalis form has been found reposing upon the surface of the ground underneath the shelter of a cultivated variety of *Vitis cordifolia*, Mich., in a very open and exposed situation; undoubtedly the identical spot which the larva reached after separating itself from its favorite food-plant, was the scene of its assumption of the chrysalis state. This circumstance appears curious and unique, in view of the fact that ordinarily there is a disposition upon the part of larvæ to seek *sequestered situations*.

After this rehearsal of facts to show that the surroundings of a species operate to produce functional changes within its economy, the rare occurrence of a cocoon-making species laying aside this hitherto supposed indispensable habit, becomes divested in a measure of the mystery which envelops it, without losing any of its interest.

To assign a cause for this anomalous natural occurrence shall be my aim. In a series of experiments which I recently conducted of starving larvæ to ascertain the effects produced upon their economy, I have been led to observe that in cases effectually accomplished, there is, besides a remarkable diminution in natural size, in cocoon-producing species, as Cecropia, Polyphemus, etc., a considerable saving of silk. Last year I produced cocoons of Polyphemus, three-quarters of an inch in length, by less than one-half in thickness. The flies which emerged from these cocoons measured $1\frac{3}{4}$ inches in expanse of wings. In the generality of cases *males* were the result of starvation.

This last year I fed a number of Cecropia upon the leaves of our ordinary red currant. One of the cocoons which I gathered was less than one inch in length with a thickness of one-half inch. Prompted by curiosity, I tore the cocoon open and discovered that the larva had been *ichneumoned.* In the place of a chrysalis was found the black cylindrical cocoon such as we ordinarily find in such cases. The larva had undergone its skin shedding, as evidenced by the dried inverted skin which was shoved into one corner of the cocoon. In this case, the larva, being weakened and diseased by the ravages of an internal foe, had not the material, or the power, to construct the characteristic type of cocoon. In the case of Polyphemus adverted to, scarcity of food, and of an innutritious character in the bargain, had reduced the insect to a condition which rendered it powerless to produce the typical form.

May not the stinting process which necessity compelled me to adopt with some larvæ of *Acronycta*, have had the effect of determining the acquired habit which has been noticed? The silk-producing glands of *Acronycta*, in consequence of a diminished supply of aliment, were not provided with the requisite material for the manufacture of silk, there being a bare sufficiency of food to prevent starvation to the insect. These silk organs are most developed at the period when the insects approach their pupa state; but with the larvæ of *Psychidæ*, *Tortricidæ*, and *Lasiocampidæ*, they are already active during the early epochs of life. As the necessity for their use mainly occurs in the interval between the last skin moulting and assumption of the pupa form, they would attain during this period their functional maturity. There may be instances where growth has received a check through adverse climatic influences or otherwise, and the functional activity of these glands has been early attained. If in *Acronycta* the mature stage had been reached, and the nutriment provided was insufficient to maintain both the life of the larva and the functional activity of the glands, it seems evident that the most vital organs would be sustained at the hazard of those less vital.

In larvæ which do not manufacture cocoons the silk-bearing glands exist, but so reduced in size that they are functionally useless where great quantities of silk are required. It is true these larvæ manufacture silk, but in such exceedingly limited quantities as to be of little or no service for cocoon-making. The Diurnals, as is well known, are able to spin several strands, by which they suspend and engirdle themselves when about to pass into chrysalides. Some moths of the great family *Bombycidæ* make no cocoons, but these are the exceptions rather than the rule. The major part of them are cocoon-builders. While some construct the merest apology, others, Cecropia, for example, attain to the highest perfection in the art. The *Arctians* produce very little silk in comparison with Cecropia; their silk-bearing glands being necessarily small. The larva of *Arctia achaia*, Grote, spins a very thin web of a drab color, through which the chrysalis is distinctly seen. The *Sphinges* would seem to occupy an intermediate position; the earthen cells which they build, with their slight lining of silk, being the homologues of cocoons, since they subserve the same essential purpose. *Thyreus Abbottii* seems to be a real exception. But no. It ordinarily seeks some sheltered locality in which to undergo its critical changes—the under surface of a fallen log or a board, where an abundance of decomposing leaves affords the necessary warmth and shelter. It is obvious that the necessity for a cell does not exist, if the foregoing facts afford any criteria.

In the anomalous cases of *Acronycta* referred to above, it seems to me that we have proofs of the manner in which cocoons have come to be dispensed with in certain *Bombycids*. That *defective nutrition* has been a principal cause almost amounts to a conviction. A parallel case is cited by Stretch in his "Zygænidæ and Bombycidæ of N. A." Having taken a number of larvæ of *Arachnis picta*, Packard, on the 9th of May, 1870, near San Francisco, he placed them in a box, and furnished them with a plentiful supply of their appropriate food for two weeks. They declined to eat, however, and remained thus for a period exceeding three months, when they passed into chrysalides, a few without spinning cocoons. The remainder, as though all the moisture in the body had been eliminated during their protracted fast, wove a very thin open white web, dotted with minute glistening beads like tiny dew-drops. Here there can be no doubt as to the part which *lack of nutrition* has played. If these examples of almost complete starvation had appeared late in the season, the effects would have been attributed in a measure to climatic influence; but, in the language of Mr. Stretch, they were brought about "in the height of summer."

Some few of the *Bombycidæ* are not cocoon-builders, but merely pass into chrysalides. On the principle that these are the modified descendants of pre-existent forms that possessed the habit, we are prepared to explain very much of the mystery which envelops *Acronycta* and *Arachnis*. This acquired habit upon the part of each, if permitted to bear offspring, would no doubt react favorably in the line of higher development. At this point a few hints upon the present natural arrangement of lepidopterous life upon this planet can not be amiss.

Among Lepidoptera the *Rhopalocera* constitute the highest division of the suborder. The arrangement of A. S. Packard, Jr., in his "Synthetic Types of Insects," seems to countenance no other idea. The *Heterocera* embrace all that were formerly known as Crepuscular and Nocturnal Lepidoptera. These terms, with that of Diurnal, which were once applied to the entire suborder, though strictly unnatural, subserve a good purpose.

This arrangement harmonizes in a measure with their natural sequence in time. If the highest types of life are the modified descendants of pre-existent forms, then, from an evolutionary point of view, Butterflies, which are assumed to be pre-eminent among Lepidoptera, have sprung from the *Bombycidæ*. There has undoubtedly been a gradual succession from certain Nocturnals to Diurnals.

There seems to be a tendency now-a-days upon the part of naturalists to refer the entire animal creation to a primordial form—the *Protamœba* of Hæckle, from which has been reached through endless ramifications the present *regime.*

That our myriad forms of Butterflies have arisen from a single form in a uniform direction, is an hypothesis that cannot be entertained, in view of the array of evidence to the contrary. They have certainly reached their present *status* by several roads; but assumed in their entirety, there can be no question about their evolution from the *Bombycidæ.*

The *Sphinges* have been possibly reached from a Trichopterous form through the *Noctuidæ* and *Bombycidæ.* Although this family does appear to hold an intermediate position to Diurnals and Nocturnals, and would seem to form a principal link in the chain which has led to the former; still the absence of any positive testimony upon this subject effectually precludes any such arrangement. Were this the road by which the higher types have been reached through the play of natural forces, we should expect to meet some of the old landmarks, or to see in existing forms some proofs thereof.

The *Ægeridæ* must also be traced back to a pre-existent Caddice-fly. In their general form, in the outline and the transparency of their alar appendages, in their manner of flight, and the time of the day when they are most active, the *Ægeridæ* approximate the *Hymenoptera.* The genus *Trochilium*, of this family, resembles in all the above particulars many of our ordinary Membranous-winged insects. While this family undoubtedly leads forward to the *Hymenoptera*, it reaches backward and claims a near alliance with the *Zygænidæ.*

These facts have strongly impressed my mind as to their near relationship; and the thought has been frequently suggested, may not the *Hymenoptera*, the highest of insect life, have been reached through some member of the *Ægeridæ.* As *Trochilium* bears the nearest approach to a *Hymenopteron* of any form of Lepidoptera with which I am familiar, so the genus *Cosmosoma* of the *Zygænidæ* in many particulars resembles *Trochilium.* From the *Zygænidæ* to *Phryganea* through the *Noctuidæ*, retrocession is moderately gradual.

An examination into the provisions which lepidopterous larvæ make preparatory to entrance upon the chrysalis state, rather countenances than opposes this theory. From the cocoon of the least developed of our moths to the loop and girdle of the *Papili-*

onidæ, etc., remarkable gradations can be established. The highest perfection in the art of cocoon-manufacture is attained by members of the old Linnæan genus, *Attacus*. Between the lowest moths and the lowest type of butterflies a wide gulf intervenes. This is bridged over by many small genera, which enable us to reach the latter by a slightly circuitous course. Leaving out the genus *Attacus*, there seems to be a more nearly continuous route. May not certain members of this genus constitute the extreme limits of one or more branches of the great tree of lepidopterous life

The small loop by which a *Papilio* or a *Vanessa* suspends itself to a support, when about to pass into a pupa, and the girdle which it throws around the middle of its body to prevent unlimited and undue motion whereby injuries are prevented, are, it seems to me, but the last traces of the cocoon with which in primitive times it was wont to inclose itself. Indeed, there is a Brazilian moth of the subfamily *Tineina* which swings itself from a twig by means of a compound silken thread, thus imitating, though on a grander scale, many of our *Papilionidæ*, after which it spins a cocoon, a perfect network of fibres, so loosely arranged that the chrysalis may be discerned in all the distinctness of its parts. In this instance, the sole object of the cocoon, if there can be no impropriety in recognizing it as such, is not to protect its inmate from the inclemency of the weather, but to be, as it were, a domicile in which the almost immobile pupa can sleep until it wakens to newness of life. In point of utility this cocoon, judging from the laxity of its formation, is but little superior to the slight silken covering with which some of our earth-seekers line their cells. *Alucita porectella* builds a somewhat similar cocoon ; but its beautiful network, rivalling in beauty the mechanism of art, is hidden away within curled-up leaves, or underneath them. There is a very close resemblance in the cocoons of the above two species. While the Brazilian larva utterly discards all extraneous objects which would mar the beauty and transparency of its house, *Alucita porectella*, for some unknown reason, selects a leaf as a basis whereon to build its showy fabric, a very common occurrence. As far as my knowledge extends, these are the only two species of the family to which they belong that do not construct cocoons of ordinary compactness. In *Alucita*, this marked looseness is in a great measure atoned for by the leafy envelope referred to. Why this deviation from what is usual in the case of the Brazilian species? The conclusion is not far-fetched. There seems to be a tendency towards the abandonment of a habit which has been proverbial. What the circumstances are, which are determining this change, it is not easy to divine. In this climate cocoons serve to protect their inmates, when placed in exposed situations, from undue moisture. Experience has shown that they are capable of enduring with impunity a high degree of cold. Successive alternations of temperature from cold to warm, and *vice versa*, are accompanied by injurious effects. In tropical countries where the year is divided into two seasons, the wet and the dry, it is during the latter that the larva changes and prepares for a winged existence; consequently, the necessity for cocoon-making does not exist.

The cocoon being of little service to this Brazilian larva, other than as a suitable and comfortable support, being a relic of the past, will doubtless in time be abandoned. The insect will by degrees adapt itself both structurally and functionally to the new conditions of its *environment*, and support itself by a girdle like that of the *Papilionidæ*.

If butterflies have been evolved from moths, we should expect to find some evidences of the fact, if not in the forms of existing species, at least to a certain extent, in the gradations which can be established between cocoon-manufacture and the almost complete abandonment of the art, save in a rudimentary state, if the girdle-like-support of the *Papilionidæ* and others can be construed as the traces thereof. If moths are the parents of butterflies, an examination into the past history of our globe as contained in its rock-structure, ought to afford some confirmatory evidence. We should expect to meet with some traces of moths, as proofs that they were the earliest lepidopterous life that inhabited this globe. A review of palæontological literature upon this subject dissipates all suppositions to the contrary.

In the iron-stone concretions from the Carboniferous beds of Morris, Illinois, besides the remains of *Neuroptera* proper and *Pseudo-neuroptera*, there have been discovered two other forms of extinct articulate life. Naturalists have described one form as a centipede, the other as a caterpillar of a moth; the caterpillar was referred to the family of *Arctians* to which our woolly bears belong. As to the propriety of so doing, Mr. Scudder, of Mass., entered a protest. To this distinguished entomologist, they have every appearance of worms. Leaving this form, therefore, as unsatisfactory for our present purpose, another advance in time brings us to the Jurassic period, where more reliable information is awaiting us. In Europe, where the formations characterizing this period are developed on a singularly grand scale, but two forms of extinct Lepidoptera have been discovered to my knowledge, and these are a moth pertaining to the lowest family, the *Tineids*, of which the clothes-moth is a well-known example, and a *Sphinx*.

In an uninhabited region beyond the Rocky Mountains, near the union of the White and Green Rivers, Colorado, exists a deposit, probably far richer in insect remains than that of Œningen in Germany. In two localities separated by a scope of country about sixty miles wide, called by Prof. William Denton, Chagrin Valley and Fossil Cañon, considerable remains have been found. It is peculiarly interesting that these two regions have every indication of being distinct; the ants, the moth, and the thrips, nearly all the small coleoptera, and the bulk of the diptera, come from Fossil Cañon; while the larva are restricted to Chagrin Valley.

While no definite conclusion can be arrived at respecting the age of the beds in which these remains are found, there can be little hesitancy in assigning them to the Tertiary epoch. Professor Denton affirms them to be at least as old as the Miocene. As far as our present knowledge extends, the great Tertiary epochs rank pre-eminently above all others in their yield of fossil lepidoptera.

In confirmation of my position that butterflies are a higher type of Lepidoptera than moths, the former being the modified descendants of the latter, through several lines of development which had, during æons of cycles, gradually almost entirely lost their cocoon making propensities, Palæontology, the key which has unravelled so many mysteries in biological science, lends its all-potent influence.

It has been seen that the earliest of moths of which the globe bears any record, belongs to the *Tineids*, the lowest family of Lepidoptera. This is what our theory presupposes. As the larvæ of these moths generally construct at the present day cocoons of remarkable compactness, analogy would seem to argue a nearly similar habit in their early progenitors of the dark days of the Jurassic period. If it were possible to bring the cocoons of species so widely separated in time into juxtaposition, perceptible differences no doubt would be noticed. Allowing for variation at the ordinary rate of increase, during the immensity of time that has elapsed since the Jurassic tineid flourished, the contrast would be astounding. While variation progresses in some species of animals by the constant addition of infinitesimally small increments, which are seen after the lapse of indefinite periods of time, there are other species which have maintained their own with comparatively few and trifling changes of character, from the early dawn of Silurian times down to the present moment. The *Terebratula* of our seas, closely resembles its most distant kin. Why may not the line which has terminated in our typical *Tineids*, have been marked by a similar uniformity of structure and habits? Other lines of growth may have led from these ancient *Tineids* to our highest types of cocoon-builders, through which in course of time our butterflies and sphinges were evolved.

If, as has been previously remarked, the habit of cocoon-building originated in the necessity of the times, as a means of protecting the builder against undue moisture, rather than a low degree of temperature, then we should expect to meet in the history of those early times, some confirmatory facts which would add further links to the chain of argument which has been assumed to prove that the line of development has been from Nocturnal lepidoptera to Diurnal.

Respecting the climate which prevailed upon the globe when the Jurassic tineid and Sphinx flourished, no facts associated with the geographical distribution of species have been ascertained, that uphold the idea of a diversity of zones, such as now exists. The facts sustain the view that the climate of the Arctic during this period was at least warm-temperate. The presence of *Belemnites paxillosus* and *Ammonites biplex*, or some closely-related species, according to the authority of Dana, in the Arctic, the Andes of South America, and Europe, indicates a remarkable uniformity of climate over the globe.

The character of the plants which then existed affords a cogent reason for believing that a moist climate prevailed. Experience has taught us that *Conifers* and trees allied to *Yucca* and *Bromelia*, *Equiseta* and *Ferns*, do best where the soil possesses much moisture and the climate is uniform. The gigantic *Conifers* of Western North America, and the tree-ferns of the East, attain their greatest grandeur where nature abundantly waters the lap of earth. Such being a true statement of facts, as at present existing, what must have been the condition of the earth and atmosphere in those early days to which we have previously referred, to have given rise to such profuse and rank vegetation? The atmosphere must have been deeply surcharged with aqueous vapor, which was frequently condensed into rain and precipitated in torrents upon the earth.

The *Tineina* are the smallest of the small among the Lepidoptera, and, perhaps, the most eccentric in their habits of life. The larvæ also vary in their habits: some feed in the open air; others in rolled-up leaves; others are miners, some case-bearers, and some feed upon clothes or the lining of upholstered articles. There can be no doubt that the situations in which the larvæ are found are well adapted to conceal such tender creatures from the rapacity of vigilant foes. The cases which these larvæ construct with so much taste and skill, after having sheltered their fragile forms during the period of feeding, serve by slight additional improvements to become fit dwelling places for pupæ while preparing for winged existence, by affording comfortable shelter from inclement weather.

Whether there existed forms closely allied in habits to *Tinea tapetzella*, *T. pellionella*, and *T. crinella*, that feed upon carpet, feathers, furs, and skin, at present, palæontology must bear answer. It is evident that the majority of the species that flourished during past ages were vegetarians, and plied their gastronomic art within some sheltering leaf or case. During this epoch there flourished various genera of *Ferns*, *Cycads*, *Conifers*, and several species of *Equisetum*, materially dissimilar to any existing forms.

If there were *Tineids* that subsisted upon feathers, and such like, as at present, they were conspicuously few in number and confined to restricted areas. The Portland dirt-bed has yielded relics of fourteen species of mammals that have been referred mostly to the marsupials, and but one or two to the non-marsupial *Insectivora*. These mammals were associated with remains of insect life. These facts encourage the idea of a possibility of hair-eating *Tineids*.

This period, being preëminently one of reptiles, when the gigantic *Saurians* lived and delighted in their carnivorous exploits, could scarcely have witnessed any remarkable development of moths.

Vegetation of a particular character being very prolific then, there is ground for believing that an excess of *Tineids* of herbivorous habits would have been better adapted to the existing condition of things.

As living *Tineids*, so far as I am conversant with their history, only attack woollen stuffs, furs, feathers, etc., when stripped from their rightful proprietors, and not when constituting their living vesture, analogy would expect a similar exhibition of character upon the part of their remote progenitors. The fur of dead animals is, however, utilized while also remaining intact.

Many of our living larval *Tineids* construct cases into which they retire and which they bear with them from place to place, when they do not otherwise tunnel the leaves of their favorite food-plants. There can be no impropriety in presuming the existence of similar habits upon the part of their distant ancestors. The warm temperate climate which prevailed during the Jurassic epoch, with its excessive moisture and humid atmosphere, offers a weighty argument in favor of cocoon, or rather case-builders.

Lepidoptera, as a rule, are exceedingly delicate and fragile beings, very liable when life is extinct to speedy decomposition. Therefore, it is not to be wondered at that their remains are not found in greater abundance. When we reflect that there have been many alterations of level since the day when the Jurassic fauna flourished, it is highly probable that many forms have irrecoverably perished. But when the rock-structure of the globe is better known, new forms may come to light, which will doubtless help to fill up existing gaps in the chain of historical sequence.

The presence of a *Sphinx* with moths that occupy so low a position in the order as *Tineids*, is a remarkable coincidence, and would seem to require a different explanation, in view of the then existing aspect of affairs, than the one which I have endeavored to establish. If future explorations and discoveries should fail to reveal the existence of lepidopterous life further back in time, or the existence of intermediate forms to the *Tineids* and *Sphinges*, it is almost impossible to resist the conclusion that these forms originated almost synchronously from some lower forms of articulate existence; in other language, that they are branches from a common scion or stock. It seems to be more in harmony with known facts to consider the *Sphinges* to have been the modified descendants of some pre-existent *Bombycid*, the latter of a *Noctuid*, etc., and to await the further developments of palæontological science in confirmation of this position.

As previously remarked, there has been found in the Carboniferous strata of Morris, Illinois, a larva that has been referred to the *Arctians* or woolly-bears. Granting the truth of this identification for the sake of argument, the period of time that has elapsed since the Carboniferous arctian flourished, down to the ushering into existence of the Jurassic sphinx, has been ample, no doubt, for the gradual evolution of an *Arctian* into a *Sphinx* through intermediate forms. The fact that *Tineids* are not found in Carboniferous strata is no argument for their non-existence. If the *Tineids* of those early days had many points in common with existing types, it is only under the most favorable conditions that parts of them could be preserved.

That these conditions did not exist during the Triassic period, is inferred from our knowledge of the disturbances which took place in America, and the shallow basins both of fresh and salt water that existed in foreign localities where this formation is developed. Evidences of disturbance occur in this country in the tilted and displaced condition of the beds constituting the formation. This tilting is, doubtless, due to mechanical force, very gradual in its action. Still further evidence exists in the profound subsidence which has been shown to have been in progress in regions of depression, occupied by the strata. Such a subsidence would obviously have brought a strain upon superincumbent beds, and sooner or later would have produced fractures and disarrangement. The injection of igneous rocks which have intersected sandstone strata, affords still another proof. In our Triassic regions, rocks of igneous origin are intimately connected with rocks of aqueous origin. Throughout most of the European sandstones and marls of this period, the occurrence of ripple-marks, rain-drop impressions, and cracks from drying, plainly show that the strata are of shallow-water and mud-flat origin; and the salt which has been found and referred thereto, points to the existence of flats that were exposed to occasional inundations of the sea, where the salt water underwent evaporation.

It is evident that in America where the greater disturbance of the strata has occurred, as indicated above, such light and airy creatures as moths would stand but a slim chance of leaving the slightest vestiges of their remains imbedded. The tilting and subsidence alluded to, combined with the metamorphic character imposed upon many strata by the injection of trap in a state of igneous fluidity, if lepidopterous life then existed, have either completely removed it from our reach, or obliterated every trace of remains once preserved.

In Europe, when we take into consideration the areas in which these beds were deposited, we are not surprised at the absence of traces of lepidopterous life. Being shallow basins of fresh water, with mud-flat margins, and occasional flats submerged by inundations of salt water, we should not expect to meet with lepidopterous life. It is only in such localities that we should look for the remains of neuropterous insects. It is a remarkable fact that the only fossil insect thus far observed is the larva (or exuviæ of the larva) of a neuropter, related to the genus *Ephemera*, which was found in the shales at Turner's Falls, on the Connecticut River, and described by Prof. Hitchcock. The impressions of the feet of insects found in the sandstones of the Connecticut River valley, were undoubtedly of neuropterous and crustaceous character.

Unless the advent of the *Tineids* dates further back in time than the Jurassic, allowing the family to be the lowest of the *Heterocera*, we have the simultaneous origin of insects as low in the scale of creation as these, with others, the *Sphinges*, which mark a pre-eminently higher type of development, unless it can be shown, which is exceedingly uncertain, that the former claim priority of birth, and constitute the immediate and proximate ancestry of the latter. The chapters of the Stone Book of Nature, so far as they are perusable, do not reveal any such history. The intermediate links by which the chain of existence from *Tineids* passes into *Sphinges*, are missing, and doubtless will never be restored. If *Tineids* have passed directly into the *Sphinges*, would not, unless our present types are the degenerated forms of pre-existent ones, some unmistakable evidences be found in studying the early stages of modern species? Instances could be multiplied beyond limit of the special roads which nature has pursued in reaching particular forms, from others that occupy an inferior position.

The simplest forms of life of which we have any conception, are the *Monera*, which may be defined as living jelly, formless and structureless. They move along by a sort of gliding motion, which is produced by a protrusion and retraction of portions of their substance. Their reproduction is exceedingly simple, being a splitting of their body into halves, each half developing into a new *Monas*.

The absence of a nucleus characterizes the chief point of distinction between these and the *Amœbæ*. A Sponge may be considered as a colony of *Amœbæ;* the individual members of which are united by a common bond of union ; this view is suggested by the young of the Sponges, which cannot be distinguished from *Amœbæ*. The development of flagella and cilia, as in *Euglena*, has led the way to the *Animalcula* or *Infusoria*. Nor need we confine our attention to these simple forms of animal life.

As we ascend the scale, we meet with equally forcible illustrations. Prof. Cope, in his "Origin of Genera," in writing about the higher *Cervidæ*, affirms that "*Rusa* and *Axis* never assume characters beyond an equivalent of the fourth year of *Cervus*. In *Dama* the characters are, on the other hand, assumed more rapidly than in *Cervus*, its third year corresponding to the fourth of the latter, and the development in after years of a broad plate of bone with points being substituted for the addition of the corresponding snags, thus commencing another series."

In the *Cephalopoda* a number of series of remarkable regularity can be established. The advance in the first place being in the complicated arrangement of the plicæ of the external borders of the septa ; in the second place, in the approach which one or both extremities of the shell make to the spiral ; and, lastly, in the position of the siphon. Alpheus Hyatt, in an interesting and important essay upon this topic, makes the assertion that the less complex forms are identical with the undeveloped condition of the more complex. His language is, "There is a direct connection between the position of a shell in the completed cycle of the life of this order, and its own development. These shells occupying the extremes of the cycle, the polar forms, being more embryonic than the intermediate forms."

Such evidence as has just been adduced of the gradual modification of living species, some of the separate links of the chain which bind the less with the more highly specialized, being observable in the history of development of individual species, is of the most positive and satisfactory character. Can we bring forward similar evidence in confirmation of the position that the *Sphinges* are directly descended from the *Tineids?* I apprehend not. Whence the simultaneous occurrence of these two forms in

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the same formation? Is it an argument in favor of the descent of the former from the latter? As an answer to this query, two theories suggest themselves; either to consider the *Tineids* to have come into existence long anterior to the Carboniferous arctian, and to have been the remote progenitor of the latter, as it has doubtless been of the *Sphinges;* or to consider the *Sphinges* as a highly specialized form of Pseudo-neuroptera with *Bombycid* and *Noctuid*-like characters.

In some of our modern classifications of insects, the Caddice worms, which are comprehended in the genus *Phryganea* are reputed as belonging to the order Neuroptera. According to Westwood, however, this genus constitutes the connecting link between the Neuroptera and Lepidoptera. Since the Caddice worms present many marks of resemblance to the Neuroptera, while in others they approach the Lepidoptera, they are considered by the above-named eminent authority as constituting a distinct order called Trichoptera.

In their larval condition, these Trichopterous insects are not altogether dissimilar to caterpillars in configuration, and construct for themselves cylindrical cases or tubes, made up of sand, small pebbles, fragments of sticks, leaves, or even shells. When fully grown, the larva secures its case to a stone, the stem of a plant, or some other fixed material, and closes somewhat the two ends with an open grating of silken threads, so as to admit the ready access of water, and keep out intruders. Within this covering the pupa condition is assumed. It bears a very close resemblance to the perfect insect, except that the palpi, wings, antennæ, and legs are shorter and inclosed in distinct sheaths and disposed upon the breast. The pupa is not so perfectly quiescent as the pupæ of Lepidoptera, since as it approaches maturity it comes to the surface, and in a few instances makes its way out of the water. It is obvious that in the points of character thus briefly detailed, there is a close relationship to the early history of Lepidoptera. But the larvæ being aquatic, which is the case with very few Lepidoptera, and the pupæ being capable of locomotion near the time of emergence from the tube, on the other hand ally them to Neuroptera.

Besides a resemblance in habits to the case-bearing larvæ of the genera *Psyche* and *Tinea*, a still further affinity has been noticed; the analogous covering of the alar appendages in the *Phryganidæ* and some *Papilios*, and the analogously spiniferous tibiæ in the two groups. DeGeer deduced this affinity from the analogous configuration of the wings, and from the internal conformation of the larvæ; Kirby from resemblances in the buccal apparatus, and Reaumur from general considerations upon insect analogies.

The *Phryganidæ* are an intermediate group to the Neuroptera and Lepidoptera, as the most satisfactory evidence, backed up by the well-balanced judgments of competent authorities, so amply and ably testifies. The *Ephemerids*, though a somewhat distant kin of the *Phryganidæ*, in the Triassic Ephemeron referred to above, is it not a plausible hypothesis that we have the progenitor, though very remotely, of the Jurassic sphinx? Future discoveries may reveal to us, when these formations are more thoroughly known, the intermediate links by which the Sphinges were reached from an *Ephemerid*-like neuropter, through a Trichopterous form allied to our present Caddice flies, thence through certain extinct species of *Noctuidæ* and *Bombycidæ*, doubtless having characters which relate them somewhat intimately to existing types. That the passage of the Sphinges proper has not been through the *Zygænidæ*, amounts to a conviction in my mind. There are reasons of a morphological character, and others that favor such a pre-conception. Among existing *Bombycids* there are forms that resemble, both in the larval and imago states, our *Sphinges* proper. *Notodonta Californica*, Stretch, is a good illustration. The larvæ, in general form, and in having a horn upon its anal segment, according to Dr. Behr, would be taken as a *Sphinx*, and doubtless would be described as such in the absence of any knowledge concerning its early stages. The imago presents, in the general contour of the body, in the attenuated form of the anterior wings, in being decidedly *chalinopterous*, and in the characteristic shape of the posterior alar appendages, a very close alliance to some *Sphinges* with which I am familiar. I do not assert the belief that this species is identical in the aggregate of its characters with the *Bombycid*, from which the Jurassic *Sphinx* sprang, but that it can be taken as a fair sample of the proximate ancestor of the latter.

As before remarked, there is some resemblance upon the part of *Phryganea* to the genus *Psyche* among moths, and the *Papilios* among butterflies; from which it might be argued that the *Bombycids*, if they have come from the *Phryganeæ*, must have passed through the *Psychidæ*. But the slight similarity of the Caddice flies, instance *Neuronia fasciata*, Say, to the *Papilios*—the highest type of Diurnals—and a similar resemblance of *Neuronia* to certain existing *Bombycids* and *Noctuids*, seem to bring *Phryganea* more closely to the *Bombycidæ*. The resemblance of Phryganea in habits to *Psyche* and *Tinea*, would, in face of previous evidence, rank these forms as branches thereof.

In a careful examination of our ordinary *Neuronia fasciata*, Say, I find that the anterior wings, in their general contour and venation, resemble the typical Neuropters; while the posterior, in the same important characters, bear a decided approach to some of our *Zygænidæ*. In general form there is some resemblance, fancied or otherwise, to Hopffer's *Gnophæla;* but a more decided likeness to some existing forms of the genus *Ctenucha* is found to exist. The contour of the first pair of alar appendages in the genus *Ctenucha* is not essentially dissimilar to those of *Neuronia*, although the variation may be slightly different. In *Neuronia*, the external margins of the posterior wings, midway between the apical margins and the commencement of the line of descent to the abdomen, display a slight curvature inwardly, producing a peculiar conformation. By examination of figured specimens of *Ctenucha*, *brunnea* and *ochroscapus* more particularly, unmistakable evidences of these curves are found to exist. From *Zygænidæ*, like these, together with *Cosmosoma omphale*, Hübner, it would seem to require but little effort upon the part of "natural selection" to reach from certain Caddice flies, through intermediate forms, living or extinct, the *Ægeridæ*. In this train of argument, I have assumed the *Ægeridæ*, from which the Hymenoptera have sprung, to have descended from some form of *Phryganea*, through the *Zygænidæ* and others, and to represent the terminus of one branch of the wide spreading tree of Lepidopterous life; and the *Sphingidæ*, through the *Bombycidæ*, *Noctuidæ*, and *Phryganea*, another.

That the *Sphinges* have descended from a *Phryganea* with *Bombycid*-like characters is entertained for several important reasons. The absence of intermediate types to the *Tineids* and *Sphinges* in the rock-structure of the globe, as far as I have been permitted to read it; the great abundance of Neuropterous life that inhabited the globe during the period when the Triassic and Jurassic faunæ flourished, from forms resembling our May flies to the highest type of the order; the very close resemblances which subsist between certain existing Lepidoptera and Trichoptera, both internal and external, in their three stages of existence as larvæ, pupæ, and imagos; and, lastly, their remarkable similarity of habits.

In commenting upon the first consideration, it strikes me as peculiarly novel and remarkable, that such delicate creatures as *Tineids* should be preserved in association with *Sphinges*, there not being the remotest affinities between them, while the intermediate types, if there are any, which palæontology alone must decide in the future, should have left not even the slightest evidence of their existence.

A few thoughts having reference to the second consideration, lead to more important results. The great abundance of Neuropterous life, both high and low, that existed during the Triassic and Jurassic epochs, backed up by the third consideration which shows that notable affinities exist between certain forms of Lepidoptera and *Phryganea*, seems to argue strongly in favor of the theory that the Jurassic sphinx was the remote modified descendant of some pre-existent Caddice fly, which latter was the offspring of some formerly-existing Neuropter.

The *Tineids* of to-day are, as a general rule, but diminutive specimens of lepidopterous life, notable alike for their inconspicuousness and insignificance. Rarely if ever attaining any remarkable development of size, they, doubtless, have retained much of their primitive character. Like some forms of *Terebratula*, as before remarked, they have maintained the even tenor of their lives doubtless for ages. Natural selection has had little play in the line of variation in this family. It has been affirmed that the Caddice worms construct cases like the larvæ of *Psyche* and *Tinea*, which they line with silk. From this it is argued that *Psyche* and *Tinea* have been evolved from some form of *Phryganea*, and that the *Sphinges* have come through the former. But this does not necessarily follow. May not the *Phryganidæ* have been the common stock of both *Tineids* and *Sphinges*, the latter being a more highly specialized type, from having been reached through greater and more persistent modifications? Perhaps there were existing in those remote ages many forms of *Phryganidæ* differing greatly in size, but still retaining similarity of habits. Granting this, for the sake of argument, there can be no impropriety in considering the *Tineids* to have been the immediate descendants of some low form of Caddice fly, and to have long since reached the limit of their capacity for further modification. They would thus constitute the summits of several small branches of the Phryganeid root from which the *Psychidæ* and *Tortricina* were derived.

Although it is possible, as previously remarked, to trace with considerable success the gradual abandonment of cocoon manufacture, from rather low moths, where it exists in wonderful perfection, to its rudimentary condition in Diurnals, and even to show certain stages which appear to have led to the cell-making of the *Sphingidæ;* yet in the absence of further evidence of a different character, in the face of previously-cited facts, it would not be advisable.

It is well known that among the *Bombycidæ* there are existing forms that resemble in some points of character the butterflies. In color, bodily form, and in being, to a certain extent, lovers of sunshine, *Utetheïsa bella*, Linn., approaches the butterflies.

Among the Zygænidæ similar relations are known to exist, as instanced by *Alypia Brannani*, Stretch. Other examples might be given, but time will not permit the merest mention of them.

The larva of *Alypia* enters the ground where it constructs an earthen cocoon, and lines it internally with a varnish-like secretion before assuming the pupa condition. In this particular it imitates certain moths.

The early history of the genus *Utetheïsa* is partially involved in obscurity. It is impossible to say where the pupa state is assumed. It seems in harmony with facts to consider butterflies to have descended from some species of *Bombycid*, whose larva possessed a comparatively smooth exterior and was a moderate spinner of silk—the support and girdle of the *Papilionidæ* and others being the remaining traces of the cocoon by which their remote progenitor was accustomed to envelop itself. The larva of *Utetheisa bella*, Hübn., has been found in the pods of *Crotelaria*, from which it is inferred that it is an internal feeder. It is yellow, with black and white rings. In markings and in its comparatively smooth integument it resembles some of the *Papilios.* If it should be shown in the future that it spins a slight cocoon, this fact would lend material aid to the views herein set forth.

The larva of *Phryganidia Californica*, with its naked skin and uninclosed and pendent pupa, reminds me of many *Rhopalocera* and some *Geometræ*. It has been classed with the *Psychidæ* by Packard, and, owing to its near alliance to Heterogynnis, which is removed by many European writers to the *Zygænidæ*, it has been placed by Stretch in that group. One of the latter's reasons for this removal is the resemblance which its larva holds to that of *Eudryas*. But its habit of carrying the last segment elevated in the air, which shows a certain affinity to some *Notodontas* as well as to *Cerura* and *Platypteryx*, and of suspending itself by the tail like the *Geometræ*, combined with the close resemblance which the wings bear to some butterflies, renders it an interesting form. The facts for the origin of butterflies herein embodied in connection with the above, aim to place it high up in *Bombycidæ*.

It has been suggested that the *Sphinges* are the remotely modified descendants of a pre-existent *Phryganea*. It is well known that the larva of the latter constructs a case into which it retires after feeding. As this case with its inmate remains in its watery element until the imago state is near at hand, if the argument previously advanced to prove the remote origin of the *Sphingidæ* through intermediate forms, from a *Phryganea* allied to existing types, amounts to aught, we have in it a clue to the habit which many of our *Zygænidæ* and *Sphingidæ* possess of entering the earth in assuming the chrysalis stage. The *Ægeridæ* in their larval stage bore into the stem of plants, and when ready to pass into pupæ, construct oblong follicles, composed of small fragments of barks and earth closely united together by the silk of the animal. This style of cover is not essentially different from that of the *Sphinges* and the *Glaucopidians*. As the ravages of these insects are confined to the inner parts of plants, it is not unreasonable to suppose that when the time for change arrives, it will be undergone where there is least trouble and least outlay of strength, in the burrows created. The *Zygænidæ*, as a rule, subsist upon the outer parts of plants On the supposition that some pre-existing individual of this family had profited by a change from outer to inner, it would be a comparatively easy matter to trace the effects which a change of *environment* would impress upon said individual. We might expect considerable alterations in larval color, form, and structure, with but a trifling change in cell-manufacture.

In the condition of larvæ the Trichoptera are vegetarians; but will occasionally attack minute fresh-water animals when driven to it by necessity. As vegetable feeders they resemble caterpillars. Suppose the stream in which some early caterpillars of caddice-like habits and forms were residents, had become dried up, or directed from its bed in such a manner as not to effect the removal of the worms, and still leave the bed humid, there is no doubt that those worms which possessed some advantage above their fellows, better suited to the altered condition of affairs, would be preserved and leave progeny. These would gradually, as time progressed, become better adapted to their condition, giving rise to a higher type of existence. A change in the specific gravity of their *environment* would necessarily have the tendency, as an obviation of the inconvenience thereby engendered, of producing changes of habit on the assumption of pupation. This hypothetical case would seemingly account for the habitudes of the *Glaucopidians* and the *Sphinges*.

Another explanation suggestive of the same idea presents itself for consideration. A scarcity of food might induce larvæ well-circumstanced in the "struggle for existence," to forsake their habitual haunt, the watery element, for the land, as a preventive to starvation. If slightly adapted to endure the change of habitat, the effects of direct atmospheric influence associated with dietetic causes, might so disturb their equipoise as to lead to a better adjustment of inner to outer actions, and thus be determinative of the same results.

While some of these larvæ, in order to harmonize inner with outer actions, or to restore as nearly as possible former modes of living, on the attainment of pupæ may have passed into the ground, others, doubtless, reached the same end by boring into the stems of succulent plants, with or without a medulla, for cover and protection, as well as for food; some again, as if reluctant to forsake their cases, the scenes of so many pleasures and adventures in the past, carried their cases with them as many of our *Psychidæ* and *Tineidæ* still do, until metamorphoses ensued; others again ceased gradually to encumber themselves therewith during their larval existence, nature having provided them with suitable protective appliances in the form of irritating hairs; dangerous-looking, though perfectly harmless spines; offensive fluids with equally offensive odors, and disgusting carneous qualities; to be only reassumed on the assumption of the chrysalis state, as suitable protections against inclement weather during this critical period of radical changes.

If the views embodied in the last paragraph have any semblance of reality, we should expect to meet with, in the habits of existing species, confirmatory proofs. Among the *Hydrocampidæ*, *Paraponyx* closely resembles in larval form and habits the Phryganeæ. Its larva is possessed of large branchiæ, besides spiracles, and its pupa is found in a cocoon amongst leaves under water. There is another species quite common in France, which subsists upon a species of pond weed. In the caterpillar state it cuts two pieces of leaf and fashions them so as to become nearly oval in shape and equal in size. These are joined by their margins by means of a little silk, the larva taking special care to leave an opening for the head and the first segments of the body. It drags this house under water, occasionally destroying it for a more substantial domicile. When it is ready to assume the chrysalis state, it attaches its leafy house securely to plants or stones in the immediate vicinity. The China Mark's caterpillar lives underneath the leaves of a species of *Lemma* in the water, and protects itself in a cylindrical case of silk covered with leaves, in which it subsequently becomes metamorphosed into a chrysalis. Here, it is evident, is the starting point for the development of the higher moths. It is not to be presumed that the *Hydrocampidæ* are the immediate descendants of the *Phryganeæ.* There may be other forms somewhat lower, of whose existence we have no knowledge. In the accompanying tree I have preferred to represent these forms under the name of *ideal Paraponyx*, and to consider them as the immediate progenitors of those whose life-history I have partially described.

The pupa of *Eudryas unio*, Riley, has been found in winter in the stems of a species of *Hibiscus*, as though the larva had been feeding in that location. *Psychomorpha epimenis*, Clem., frequently perforates a piece of old wood and changes into a chrysalis therein. Its habit of boring into some substances to prepare for the change is inveterate, and it always neatly covers up the orifice so that it is difficult to detect. Other instances might be cited. The species just cited belong to the *Zygænidæ* from which it has been assumed the *Ægeridæ* were evolved. There is a manifest resemblance to the latter, with the important difference that the larvæ of the *Ægeridæ* pass through their early stages in the stems of plants, and never forsake them until fitted for winged existence; while the *Zygænidæ* pass therein when about to change into chrysalides. There may be instances where the entire *suite* of changes is affected in such retreats. It is well known that many of the caterpillars of the genus *Gracillaria* among the *Tineids*, and the genus *Œnectra* among the *Tortricidæ*, possess similar boring propensities. Higher up on the scale of lepidopterous life the genus *Nonagria* of the family *Leucanidæ* imitate still more closely the habits of the *Zygænidæ* and *Ægeridæ*, in feeding in the stems of reeds and grasses. There may be cited instances among the *Bombycinæ*, as the *Hepalidæ*. Our own *Cossus robinæ*, Peck, is a happy illustration. The existence of a similar habit among this latter family, to that which the *Leucanidæ*, *Zygænidæ*, and *Ægeridæ* possess, does not argue in favor of the view that it constitutes a link in the chain which has led from the *Noctuidæ* to *Ægeridæ*. It shows that this family constitutes a small branch from the *Noctuidæ*.

The presence of this habit among such low forms as the *Tortricidæ* and *Tineidæ* embrace, which have deviated but slightly from primitive habits, would seem to argue for analogous habits among some unknown individuals of the *Hydrocampidæ*. When these forms in their larval condition are made the subjects of special investigation by naturalists, and new types or new individuals of existing types are brought to light, it may be the good fortune of science to record types which, instead of constructing cases like those quoted above, derive the same essential benefits by boring into the stems of submerged plants, or into the veins or parenchyma of their leaves, like the members of the Tineid genus *Lithocolletis* which mine the leaves of various plant-species from their under surface and eat their cellular structures. These beings, it is true, must necessarily be very diminutive in size.

Those which have denied themselves such comfortable and protective dwellings as are afforded by cases and tunnels, in consideration of the various defensive appliances with which nature has endowed them, are very numerous. So familiar are these, even to the most casual observer, that it does not behoove me to give the barest recital of a single example. Indeed there are cases where these external tegumentary weapons, by themselves, do not conserve to individual safety; and their unfortunate possessors are constrained to construct immense webs which afford common tenements for hundreds of individuals of particular species. This is the case with our common American Fruit Caterpillar, *Clisiocampa Americana.*

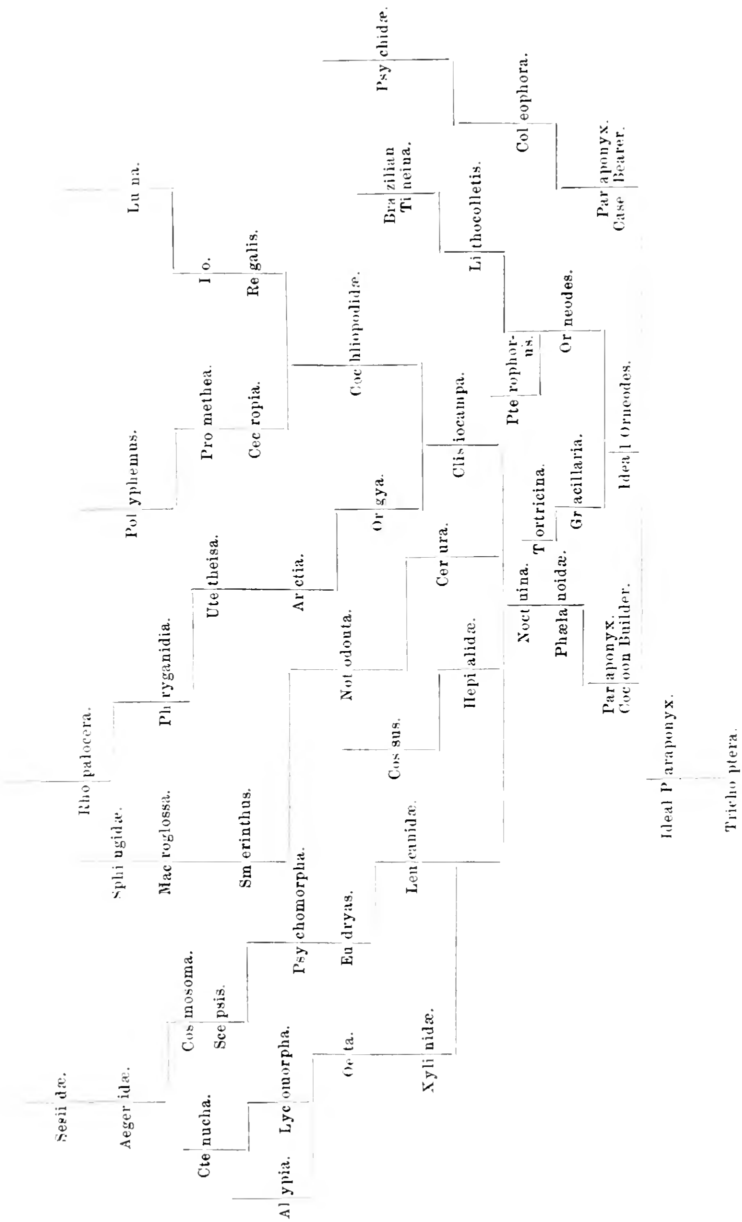
It has been said that the Caddice worms construct cases in which they reside, and which they close by means of threads at the ends when about to pupate, so as to admit the water through their interstices, and keep out enemies. It is obvious that water does not injure the pupæ. Nature, like a faithful nurse, carefully protects the interests of every one of her countless progeny by making its inner life correspond with outer actions. On the ground that water is beneficial to the pupa of a *Phryganea*, we have an explanation of the comparative openness of its cocoon at the ends.

It was further remarked that *Paraponyx* in the larval condition was endowed with both branchiæ and spiracles. This seems to be a very wise provision of nature. The branchiæ enable the insect to breathe like fishes, when immersed in a watery element. May it not be that the spiracles are quiescent, and only come into possession of their legitimate function when the chrysalis state has been assumed, and the animal is inclosed in a cocoon which is perfectly tight? As the chrysalis while in this stage respires but feebly and imperceptibly, there is in this home of its construction, an ample capacity of air for the accommodation of its wants.

It is affirmed that *Lepidosiren*, in addition to lungs, possesses both internal and external gills; the latter being in a rudimentary condition in the adult form. The rivers of South America and of the east and west shores of Africa, where this animal exists, during drouth are dried up. Did it breathe entirely by means of gills, it would be in danger of extinction during the dry season; but being endowed with lungs also, it is enabled to meet the contingency, and thus survive. Should the streams in which numbers of *Paraponyx* larvæ reside, during a season of drouth become entirely dried up, the sudden and doubly renewed efforts of these animals, in their "struggle for existence," would doubtless so operate upon the spiracles and trachea as to necessarily lead to their perfect development and functional activity. It is a familiar occurrence that the wings of moths, butterflies, etc., when first they leave the chrysalis cover, are short, sac-like, bodies; but by their energetic movements speedily develop into their characteristic forms. This is accounted for in the following manner:

These wings are pervaded by numerous minute divisions of the trachea, which, by the violent motions of the wings, are supplied with a superabundance of air, the necessary consequence of redoubled vigor. The continual pressure of fresh accessions of air upon what already exists in the above vessels, exerts an expansive influence upon the wings, which ultimately assume configuration. Such being a faithful statement of facts as we find them, there can be no hesitancy in assuming that a change of conditions as above indicated, in the animal's violent struggles for existence, would so react upon its hitherto quiescent spiracles as to conduce to their functional activity. Like the adult *Lepidosiren*, there may yet be discovered some unknown *Paraponyx* which possesses these gills only during its early larval history. The presence of gills and spiracles in the known specimen, argues in favor of its derivation from a type that possessed gills alone. If these spiracles are quiescent, and only become active in a measure during the period of pupation, as has been presumed, the passage into forms that possess this gill-breathing power during their early larval period, and thence into others that have completely renounced it, is exceedingly gradual. Some of these *Hydrocampidæ*, it is affirmed by Duncan in his "Transformations of Insects," have branchiæ or gills, and exist surrounded and bathed by water. This fact conducts to the inference that they are wholly gill-breathers. From a *Paraponyx* possessed of both gills and spiracles to the *Phryganea*, is but a moderate transition. However, it is not presumed that said Paraponyx has been immediately derived from a *Phryganea*, neither is it predicated that the complete gill-bearing form has been the proximate descendant of a *Phryganea*. But so closely do the larvæ of *Paraponyx* in form and habits resemble existing Caddice worms, that the conclusion based upon their near relationship, seems irresistible. May not the branchia-bearing form of *Paraponyx* have been the immediate descendant of some pre-existent form of similar habits, but of closer resemblance to *Phryganea*, in details of form and structure, in a state of maturity? Acting upon this consideration, I have presumed their derivation from a form at present unknown, which I have previously designated the *ideal* type.

Having somewhat lengthily detailed the truths which have led to the views expressed in this paper, it becomes me to put them to a proper test. With a view to give tone and character thereto, the idea of constructing a tree of life, based upon the habits of the *Heterocera* during their larval history, suggested itself to my mind. After many hours of toil I have been enabled to construct a tree which will, I hope, bear the scrutiny of investigation and come out unscathed, since it harmonizes in the arrangement of its parts with the most thorough system of classification.


Sesiidæ.
Aegeridæ.
Ctenucha.
Alypia.
Lycomorpha.
Cosmosoma.
Scepsis.
Psychomorpha.
Eudryas.
Oeta.
Xylinidæ.
Sphingidæ.
Macroglossa.
Smerinthus.
Leucanidæ.
Rhopalocera.
Phryganidia.
Cossus.
Notodonta.
Hepialidæ.
Utetheisa.
Arctia.
Cerura.
Orgya.
Polyphemus.
Promethea.
Cecropia.
Cochliopodidæ.
Clisiocampa.
Noctuina.
Phalænoidæ.
Tortricina.
Gracillaria.
Pterophorus.
Orneodes.
Ideal Orneodes.
Paraponyx.
Cocoon Builder.
Ideal Paraponyx.
Trichoptera.
Luna.
Io.
Regalis.
Brazilian
Tineina.
Lithocolletis.
Psychidæ.
Coleophora.
Paraponyx.
Case Bearer.

NOTES ON THE NOCTUIDÆ, WITH DESCRIPTIONS OF CERTAIN NEW SPECIES.

BY H. K. MORRISON, CAMBRIDGE, MASS.

Charadra decora, nov. sp.

Expanse 57 mm. Length of body 23 mm.

Eyes hairy. Antennæ simple, black. Abdomen yellowish. Anterior wings white, with the usual markings black, wavy, and distinct; the ordinary lines are marked on the costa by heavy oblique black dashes; half-line present; interior line strongly lobed; the orbicular spot black, figure-eight shaped, very conspicuous; median shade present; the reniform spot large, irregular, open above and below; the exterior and subterminal lines are drawn close together, forming wavy, irregular bands across the wings; at the costa and internal angle the subterminal line forms large black blotches; a series of short terminal black lines on the nervules; fringe white, chequered with black. Posterior wings pure white, with a single heavy oblique black dash at the anal angle. Beneath white.

Hab. California.

This large and beautiful species is closely allied to our three smaller Eastern ones.

The white ground color, the peculiarly shaped orbicular spot, and the black mark at the anal angle of the posterior wings will serve to identify it.

Agrotis badicollis, Grote.

Ammoconia badicollis, Grote. Bull. Buff. Soc. Nat. Sci., vol. i. p. 136. Pl. 4, fig. 18 (1873).

We do not think Mr. Grote's reference of this species to *Ammoconia*, Led., can be followed; the type of that genus, the European *A. cæcimacula*, W. V., is a large, heavy-bodied insect, having a broad massive front, pyramidal-toothed antennæ, and long hairy lashes to the eyes; the species in question has none of these characters, it agrees with the species of Agrotis having pectinate antennæ, and is intimately related to the following new species.

Agrotis dilucida, nov. sp.

Expanse 38 mm. Length of body 18 mm.

♂ ♀.—Eyes naked. The antennæ of the male strongly bipectinate. The anterior tibiæ unarmed. The thorax with a slight prothoracic crest. Second joint of the palpus triangular, brown on the sides; the third joint slight and short, and with the upper surface of the second, white and contrasting.

Ground color of the anterior wings cinereous, overlaid with brown; the lines are indicated on the costa by conspicuous oblique brown dashes, below they are simple, brown, and less distinct; half line present; the interior line below the costal dash, perpendicular, strongly lobed; the claviform spot absent; the ordinary spots are almost equal, filled with reddish-brown; in one male specimen the reniform is white and contrasting; the exterior line is dentate, strongly produced around the reniform, below it is obsolete; a series of yellow dots preceded by irregular brown blotches mark the subterminal line; the terminal space more distinctly cinereous.

Posterior wings brownish fuscous, with brownish-yellow fringes; no traces of the discal dots or median line.

Beneath reddish-brown, with discal dots and a distinct common median line.

Hab. New Hampshire.

We have seen three specimens of this fine species captured by Mr. C. P. Whitney, at Milford.

The species is very distinct, the pectinate antennæ of the male and the unarmed anterior tibiæ separate it from almost all the other species of the genus. There is considerable sexual difference in other respects than the antennæ; the males are more purely cinereous, and have the reniform spot white and conspicuous, the yellow subterminal spots are also obsolete (at least in the two specimens we have seen); the females are brown, with the cinereous tint almost entirely confined to the costa and terminal space, the ordinary spots are brown and concolorous, and the subterminal spots are yellow and distinct.

This species approaches M. Guenée's *Noctua elimata*, from Georgia, but it differs in several essential particulars.

Agrotis brocha, Morr.

Agrotis brochus, Morr., Proc. Bos. Soc. Nat. Hist., vol. xvii. p. 163 (1874).

Anterior tibiæ spinose. Sides of the palpi brown, above gray and concolorous with the front. Collar blackish, disconcolorous. Anterior wings gray, having a broad costal band, the terminal space and the neighborhood of the spots suffused with dark brown;

interior line perpendicular, geminate; claviform and orbicular spots absent, the reniform distinct, black with an irregular pale annulus; median shade distinct; the exterior line reduced to a series of black dots on the nervules; terminal space dark-brown. Posterior wings white, with a faint discal dot.

Beneath light gray, with discal dots and traces of the median lines; the basal and median spaces on the anterior wings blackish.

Hab. Colorado, Nebraska.

Our type of this species was defective and rubbed; the recent receipt of several specimens in fine condition enables us to give a complete description.

We consider it our representative of the European *A. corticea.*

Agrotis plagigera, Morr.

Proc. Bos. Soc. Nat. Hist., vol. xvii. p. 163, 1874.

Our type of this species was captured in Colorado; we have since received specimens from other localities which show that it is also found in other Western States. It is allied to *A.* 4 *dentata* and *A. messoria*, and it is possible that it may ultimately be considered a variety of the former. The ground color of the anterior wings light-gray, slightly tinted in the median space with ochreous; the costa is light and the nervures dark, accompanied by faint whitish shades; the half-line and the median lines are geminate, denticulate, and distinct, the median shade simple, but also distinct; the subterminal line is light, preceded by a series of cuneiform black markings; the terminal space blackish; the spots are all present, the orbicular and reniform large and whitish, with gray annuli, the claviform concolorous, black-edged, and conspicuous.

The posterior wings gray, with a darker diffuse terminal shading.

Hab. Colorado, Kansas, Illinois.

Agrotis redimicula, Morr.

A. redimacula (err.), Morr., Proc. Bos. Soc. Nat. Hist., vol. xvii. p. 165 (1874).

Since describing this species we have obtained specimens from widely separated places which show it to be spread over the Eastern, Middle, and Western States.

The following are some of these localities: Colorado (T. L. Mead); Missouri (C. V. Riley); New York (T. L. Mead); Long

Island (Fred. Tepper); Albany, N. Y. (J. A. Lintner); Boston, Mass. (H. K. Morrison); Maine (A. S. Packard, Jr.).

The specimens show little or no variation; the following are the characters of the species: All the tibiæ spinose; ovipositor of the female slightly extended; the collar with a distinct heavy black line.

Coloration of the anterior wings entirely black, and light and dark cinereous; a very distinct thick basal dash; interior line black, oblique, nearly straight; to it the small black claviform spot is attached; three very conspicuous, equal, light cinereous subcostal spots, the first and second (a basal spot and the orbicular) separated by a clear black, triangular spot, the second and third (the orbicular and reniform) separated by a quadrate spot of the same color; the median shade absent; exterior line black, geminate, preceded by a darkening of the ground color; the subterminal line light, followed by the dark terminal space; the fringe lighter cinereous.

Posterior wings uniform dark fuscous in eastern specimens; in the Coloradan specimens there is a quite distinct terminal dark-gray band.

Beneath gray, not characteristic. On the anterior wings of this species there are three shades of cinereous, the light cinereous of the subcostal spots, the dark cinereous of the terminal and latter half of the median space, and a cinereous shade between the two which prevails over the rest of the wings.

Agrotis rileyana, Morr.

Proc. Bos. Soc. Nat. Hist., vol. xvii. p. 166 (1874).

We have recently received from Mr. Thos. E. Bean, beautiful specimens of both sexes of this rare species, and we improve the opportunity to give a more extended description of it.

It belongs to the group of which *A. messoria*, Harr., is the most common and widely spread member; it differs from this species by the bipectinate antennæ of the male and from all other species of the genus by the coarse rough squamation of the anterior wings; the scales are almost as large as those of *Valeria grotei*, Morr.

The species is stout and robust, and the terminal spines of the anterior tibiæ are very large and heavy; the median lines are simple and distinct; the ordinary spots are black, widely separated; the orbicular small, placed close to the interior line; the reniform very large and conspicuous.

The posterior wings are white, with a diffuse gray border, very narrow in the male, in the female wider and extending up the nervules.

The sexes also differ in another particular: in the males the anterior wings are clear gray; in the females the wings are overspread with ochreous scales which extend over the thorax.

Hab. Illinois, Missouri.

Agrotis gladiaria, Morr.

Proc. Bos. Soc. Nat. Hist., vol. xvii. p. 162 (1874).

This species is allied to the European *A. vestigialis*, Rott.

We have received specimens from St. Catharines, Canada, recently sent us by Mr. George Norman. They were captured May and July, 9.

The antennæ of the male is bipectinate. On the anterior wings the costa in the male is whitish and contrasting, in the female dark and concolorous; a black basal dash; the interior line is only seen below the median nervure, it is then for a short distance quite distinct, and to it is attached the black-lined claviform spot; the orbicular spot is small, the reniform large and dark; the subterminal line is preceded by a series of more or less distinct black cuneiform markings; all the nervures are accompanied by pale contrasting shades, more prominent in the males; posterior wings dark fuscous. Beneath nearly uniform grayish fuscous, with traces of the discal dots.

Hab. Mass., Canada.

Argrotis unimacula, Morr.

Proc. Bos. Soc. Nat. Hist., vol. xvii. p. 166 (1874). *A. haruspica*, Grote, Bull. Buff. Soc. Nat. Sci., vol. ii. p. 214 (1875).

Mr. Grote states that our name is preoccupied; this is an error, the name is used by Dr. Staudinger for a simple variety of the common *A. plecta*, Linn.

Since describing *A. unimacula* we have received many other specimens of the species, principally from Messrs. J. A. Lintner and T. L. Mead; the orbicular spot is not always absent, and quite frequently both spots are present.

Mamestra thecata, Morr., nov. sp.

Expanse 32 mm. Length of body 14 mm.

This is a well-marked, comparatively slender-bodied species related to *M. incincta*, Morr. Eyes hairy. Antennæ simple in both sexes. Thorax with a slight prothoracic tuft, concolorous with the anterior wings. Abdomen short, untufted.

Ground color of the anterior wings light yellowish-gray, almost entirely overspread with blackish, the lighter color appearing principally between the geminate median lines, and in scattered patches on the basal, median, and subterminal spaces; a distinct black basal longitudinal dash; interior line straight, oblique, denticulate, its outer component line black and best expressed; median shade obsolete; ordinary spots unusually small, black, with incomplete ochreous annuli, the reniform followed by a light spot; exterior line black, geminate, its inner component line the most distinct; it is incepted on the costa directly above the reniform spot, boldly produced around it and drawn in below it, narrowing the median space; subterminal line obsolete; a distinct broad light subapical streak; terminal space black, a yellowish line at the base of the concolorous fringe.

Posterior wings whitish, with a discal dot, narrow connected median line and a broad suffuse blackish terminal band; an interrupted black line at the base of the whitish fringe.

Beneath, yellowish white, sprinkled with numerous black atoms; discal dots distinct, as well as a very prominent black median line.

Hab. Glen Valley, near Mt. Washington, N. H., and Plymouth, Mass.

The former specimen was received from Mr. S. H. Scudder, the latter from Mr. Edward Burgess, and was taken July 23, 1867.

The species is quite different in form of markings and color from our other Mamestræ, and we think will not be difficult to recognize.

Oncocnemis meadiana, nov. sp.

Expanse 29 mm. Length of body 12 mm.

Eyes naked, with short lashes. Antennæ of the female simple. Abdomen untufted, with a short projecting ovipositor. Tibiæ not spinose, the anterior pair provided with a slender claw at the extremity.

Anterior wings clear bluish-gray, the markings black; interior line regularly arcuate; orbicular spot round, black-ringed, crossed by the median shade, which is straight and oblique; the reniform spot stained with red, incompletely surrounded by a black annulus; the exterior line curves closely around the reniform and is much drawn in below it, thus narrowing the median space; the subterminal line is white, jagged, and irregular, preceded and followed by black stains; a black terminal line, followed by a clear white line at the base of the gray fringe.

Posterior wings white, without discal dots and with a black suffuse terminal border; the nervules are tinged with black; fringe white.

Beneath, the anterior wings are gray, with a few scattered white scales on the costa and terminal margin; posterior wings white, with traces of a black costal and terminal border.

Hab. Colorado, Aug. 18 (No. 47, Mr. T. L. Mead).

Mr. Mead's collection is particularly rich in species of the genus *Oncocnemis*, this being the fifth he obtained in Colorado. We dedicate it to him in recognition of his ability as a collector as well as a student; the specimens obtained on a single summer's tour having furnished material for at least half a dozen long papers by different lepidopterists.

O. meadiana approaches to *O. chandleri*, but it is a much smaller and less robust insect; the terminal band of the posterior wings is not regular and well-defined, but diffuse and extends into the white median space along the nervules.

Hadena suffusca, nov. sp.

Expanse 44 mm. Length of body 19 mm.

Allied to *H. apamiformis*, Guen., and agreeing with that species in its structural characters, excepting that the third palpal joint is perceptibly longer, and that the middle dorsal abdominal tufts are obsolete.

Head and thorax light brown.

Coloration of the anterior wings brown on a light gray ground; the brown tints are strongest on the costa and in the upper part of the median space; along the inner margin and in the subterminal space the ground color prevails; the subterminal line is preceded by a series of brown blotches, and following it the terminal space is tinged with bluish.

The ordinary lines and spots formed as in *H. apamiformis*, except that the interior line extends direct to the inner margin and does not form an outward projection on the submedian nervure.

Posterior wings as in the related species.

Beneath both wings are strongly suffused with brown.

Hab. Mass., Conn., Colorado.

We have been acquainted for some time with a poor specimen of this form from Massachusetts, in the collection of the Boston Society of Natural History, and have considered it a variety of *H. apamiformis*, but the discovery by Mr. T. L. Mead of concordant specimens from Colorado and Connecticut, and the capture by Mr. Moring of several specimens at Nahant, Mass., during the past summer, convinces us that it is distinct from the above species.

The delicate brown tints of the anterior wings will always distinguish it.

Mamestra rufula, nov. sp.

M. brassicæ (Linn.) Grote, Bull. Buff. Soc. Nat. Sci., vol. i. p. 103, and vol. ii. p. 12.

We have compared specimens of our species with a considerable number of examples of the European *M. brassicæ*, and are satisfied that they are distinct from one another, although closely allied *M. rufula* is larger and has the anterior wings comparatively broader; the reniform spot is smaller, rectangular, and better defined; there is a distinct white blotch before the inner angle, followed by a reddish shade; beneath both wings are strongly suffused with reddish-brown, most evident along the costæ.

The latter character is the most conspicuous, although perhaps not the most valuable in separating the species.

We have specimens of the American species from Massachusetts, New York, Illinois, Missouri, and Indiana; it does not appear to be of very rare occurrence, though by no means so common as *M. brassicæ*.

Actinotia derupta, nov. sp.

Expanse 34 mm. Length of body 15 mm.

Eyes naked. Tibiæ unarmed. Thorax smooth and untufted; abdomen also untufted. Anterior wings and thorax yellowish-gray, with brown markings; on the former the ordinary lines and spots are very indistinct and diffuse; a dark brown basal streak, and another similar streak beneath the submedian nervure; a streak extends along the inner margin to the exterior line; the interior line and the claviform and orbicular spots are obsolete; the reniform is present as a distinct but diffuse blackish-brown spot; a series of brown markings along the costa; exterior line indistinct, formed of sharp internervular indentations; the inner angle yellowish-gray, without brown intermixture.

Posterior wings whitish, iridescent; without markings. Beneath, on the anterior wings, the reniform spot is reproduced, and the nervures are distinctly tinted with blackish-brown.

Hab. Texas, September 21.

This species resembles somewhat the figures of *Phalæna phytolaccæ*, Sm. Abb. (which is still unidentified), but differs in several material points. The figures appear to be coarse and over-colored, so that the species intended will be difficult of determination.

Hadena inordinata, nov. sp.

Expanse 35 mm. Length of body 17 mm.

Eyes naked. Abdomen tufted. Thorax with the usual tufts.

Markings of the anterior wings confused, black, white, and yellowish-brown; a narrow basal dash, and another on the inner margin beneath the submedian nervure; interior line black, geminate and dentate, with a whitish included shade line, extending obliquely outwards to the submedian nervure, then quickly drawn in; claviform spot indistinctly outlined; median spots blackish, with white annuli, the orbicular elongate; the exterior line rounded above, below straight, its included white shade line very distinct; the median space is more or less suffused with yellow-brown; it is most contracted at the submedian nervure, above which the median lines are sometimes connected by a black streak, but this streak is frequently obsolete and its place filled by two short black markings before the exterior line; subterminal line white, with the usual distinct teeth, preceded by a series of very distinct black cuneiform markings; terminal space blackish; a series of black lunules at the base of the checkered fringe.

Posterior wings yellowish-brown, with the costa shaded with gray; discal dots, a distinct narrow median line, and a broad black terminal band.

Beneath, with very conspicuous discal dots on both wings, as well as traces of median and terminal shade bands.

Hab. Massachusetts, in June, from our collection.

This species is allied to *H. cariosa* and *H. sectilis*, but will at once be distinguished by the color of the posterior wings and the arrangement of the black bands thereon.

Hadena stipata, nov. sp.

Expanse 36 mm. Length of body 17 mm.

Sides of the palpi black, the third joint short and barely separated from the second. Abdomen smooth and untufted.

This species is closely allied to *H. cariosa*, but it differs in the important particulars mentioned above, as well as in the color of the posterior wings, which are white with only a faint terminal gray border.

All the nervules are accompanied by deep purple black shades, between which the ground color appears; the ordinary spots are indistinct, but shaped as in *H. cariosa;* the three longitudinal deep black dashes are present as in the former species; the exterior line is also present, but it is white and fine, and is not crossed by the median dash; the lower portion of the median space above the submedian nervure and the terminal space are purple black; the inner margin is clear and light.

Beneath, both wings are white at the base, but suffused with gray atoms outwardly; the discal dots indistinct.

Hab. Illinois. One specimen received from Mr. Thos. E. Bean.

H. stipata is very closely allied to *H. verbascoides* and *H. cariosa*, but we think the characters above mentioned are sufficient to separate it.

The discovery of more specimens will determine its claims to the rank of a good species.

Hadena paginata, nov. sp.

Expanse 24 mm. Length of body 9 mm.

Abdomen smooth and untufted. Form slight. Habitus and markings of *H. rasilis*, Morr., and *H. chalcedonia*, Hübn.

Ground color of the anterior wings uniform gray, the markings very simple; the median lines are black and simple, the exterior line extends from the inner margin just before the internal angle, obliquely across the wings, turning out, and forming a rounded projection opposite the reniform spot; the interior line extends obliquely to the usual place of the orbicular spot, it then continues irregularly to the costa; the half-line present; the ordinary spots are very small, the orbicular usually obsolete, the reniform whitish; they are connected by a narrow intense black dash, which sometimes encircles the spots, thus uniting together the median lines; the subterminal line obsolete. Posterior wings white, usually crossed by a blackish median line.

Beneath, the anterior wings are blackish, the posteriors white; both are crossed by a common median line.

Hab. Florida (Mr. C. J. Maynard).

This species apparently occurs rather abundantly in the localities where it is found; on this account we have compared it very carefully with M. Guenée's descriptions of *H. festivoides* and *H. exesa*, which are still unidentified, but it can hardly be either of them.

Mr. Maynard also captured a number of interesting species, several of which have not been recorded from Florida before.

We name a few of them: *Litoprosopus futilis*, G. and R.; *Tarache terminimaculata*, Grote; *Pseudolimacodes niveicostatus*, Grote; *Amolita fessa*, Grote; *Phurys vinculum*, Guen.; *Agrotis incivis*, Guen. (*Anicla Alabamæ*, Grote). We do not think this species should be separated from the other agrotids on account of the scaly clothing of the thorax, several of the European species the thorax likewise scaly, or covered with mingled scales and hair; *Harveya auripennis*, Grote, in this specimen there is no black stain on the inner margin; *Callopistria mollissima*, Guen.; and *Hadena arna*, Guen., the latter species is now for the first time identified in our collections.

Laphygma inflexa, nov. sp.

Expanse 30 mm. Length of body 13 mm.

Eyes naked. Tibiæ unarmed. Head and thoracic parts as in *L. frugiperda*, Sm. Abb. Anterior wings cinereous gray; half-line present; interior line distinct, simple, and angulate; the costa to the exterior line is shaded with white; orbicular and claviform spots absent, the reniform whitish, of medium size, its annulus black and circular; exterior line black and very prominent, it forms a sharp outward projection on the costa; beyond the cell it is straight and below it drawn in, here forming several short sharp indentations; the line is followed by a more or less distinct blackish shade line; subterminal space largely whitish, entirely so at the costa and inner margin; terminal space dark; a black even line at the base of the fringe.

Posterior wings broad, with a well-marked angle at the termination of the third median branch; in color they are whitish, iridescent; the nervules at their termination are tinged with black. Beneath the anterior wings, except along the inner margin, are intense black, without markings; the posteriors are precisely as above, without any traces of the usual discal dots.

Hab. Jacksonville, Fla.

This species can at once be separated from its well-known congenor by the form of the posterior wings.

Orthosia ferrugineoides, Guen.

"Species Général," vol. v. p. 398, 1852.

Xanthia ralla, G. & R., Trans. Amer. Ent. Soc., vol. i. p. 346, pl. 7, fig. 49.

Xanthia bicolorago, Guen. vol. v. p. 397, 1852.

We have recently seen specimens determined as *X. ralla*, G. & R.; this confirms our previous opinion (formed from the figure and description) that it was a redescription of the common *O. ferrugineoides*, Guen.

The figure given by Grote and Robinson represents the form in which the ground color is light-yellow and the markings fine and interrupted; it is of common occurrence. The form which we think M. Guenée has described under the name of *bicolorago*, has, on the contrary, the ground color of a darker obscure yellow and all the markings very heavy and black, particularly the median shade; the terminal and the outer part of the subterminal spaces are also entirely black, and the posterior wings are crossed by two distinct median lines.

We have seen specimens in the Museum of Comparative Zoology at Cambridge, in which the whole surface of the anterior wings is overspread with black; these we would also refer to this variety.

Our American species is certainly very near to the European *O. circellaris*, but we have compared a considerable series of them both and find that there are slight but constant differences, enough we think to entitle them to separate designations.

Orthosia perpura, nov. sp.

Expanse 31 mm. Length of body 15 mm.

Eye naked, with lashes. Palpi with the third joint short and stunted. Antennæ of the male pyramidal-toothed. Front and thorax concolorous with the anterior wings. Abdomen short and untufted.

Anterior wings gray, overspread in parts with a peculiar bluish cinereous color; all the markings present, although not very well defined; half-line present; interior line indistinct, from its central lobe proceeds the brown evident claviform spot; the ordinary spots are close together, brown encircled, concolorous, and of nearly equal size; the median shade obsolete and the median space tinted slightly with brown; the exterior line indistinct, and marked mainly by the slight contrast in color between the median and the cinereous subterminal space; subterminal line brown, formed by a series of connected spots; fringe concolorous with a central brown line.

Posterior wings yellowish fuscous, with a discal lunule.

Beneath yellowish with distinct discal dots and traces of the median line on the costa of both wings.

Hab. New York.

This distinct species can be identified by the color of the anterior wings as well as the yellowish posteriors.

Orthosia differta, nov. sp.

Expanse 28 mm. Length of body 15 mm.

Eyes naked, with hairy lashes. Palpi, front, and thorax as in allied species. Abdomen smooth and untufted.

Anterior wings orange, with the markings disconnected and black; half-line present; interior line distinct, perpendicular, consisting of three broad lobes, it is formed of black spots, connected by a finer black line; claviform spot absent, the orbicular concolorous with a black central dot, and fine black annulus, the reniform also concolorous, with a central blackish blotch, and an interrupted annulus; the median shade forms a black bar above the reniform, which it touches, below it is fine and linear; exterior line of the usual form, denticulate, followed by a blackish shade line which fills in the teeth of the line; the subterminal line an interrupted series of black spots. Posterior wings yellow, with a broad orange terminal band.

Beneath yellow with orange shades, distinct discal dots, and a common median line.

Hab. New York.

Received from my very kind friend, Mr. Fred. Tepper.

Schinia gracilenta, Hübn.

Zutr. vol. i. figs. 5 and 6.

Var. oleagina, nov. var.

Expanse 28 mm. Length of body 13 mm.

Eyes naked. Tibiæ spinose, the anterior pair armed with a stout long claw.

Habitus of *S. trifascia* and *S. rectifascia.* Anterior wings uniform olivaceous-gray, the median lines are light, clear, and distinct, not accompanied by darker shades; the interior line curves outward on the costa and then extends obliquely back, parallel with the exterior line, the latter is oblique and very slightly undulating; the subterminal line also parallel, less distinct, and followed by longitudinal light shades along the nervules.

Posterior wings yellowish-white, with a faint terminal rosy border.

Beneath nearly uniform in tint with traces of terminal reddish borders.

Hab. Texas.

One specimen received from Mr. E. L. Graef, of Brooklyn.

The following are the points of difference between this specimen and Hübner's figures of *S. gracilenta;* they are considerable, but the general resemblance is so great between the forms that we cannot think them specifically distinct, at least until more material is received: in *S. gracilenta* the exterior line is more curved, particularly on the inner margin, the subterminal space is dark and contrasting, the posterior wings have a well-defined gray border instead of a rather faint rosy one, and finally the anterior wings beneath have a distinct discal dot and median line, which are entirely absent in *S. oleagina.*

S. gracilenta is one of Hübner's unidentified species, and is marked unknown on Mr. Grote's recent list.

Schinia tepperi, nov. sp.

Expanse 21 mm. Length of body 8 mm.

Eyes naked. Anterior tibiæ absent in the single specimen of the species before us, which is otherwise in good condition; probably they are armed with curved claws as in the other species of the genus. Abdomen short and untufted. Front and thorax with smooth, concolorous, scaly squamation.

Ground color of the anterior wings olivaceous gray; the wings are crossed by three white lines; the first or interior line extends obliquely from the inner margin to the costa; the second or exterior line extends subparallel with the former from the middle of the inner margin toward the apex, but on reaching the fifth subcostal nervule it turns abruptly, reaching the costa at about two-thirds of the distance from the base to the apex; a triangular space extending from this upper portion of the exterior line to the apex is dark olivaceous gray and contrasts with the ground color; the third or subterminal line is as distinct as the other lines, and extends from the inner margin to the apex, nearly parallel with the outer border; the fringe light; the median nervule is tinged with white, the reniform spot is also faintly seen as a white cross line.

The posterior wings are uniform light olivaceous gray. Beneath the markings are light gray, not at all distinctive.

Hab. Texas. September 15.

We dedicate this species to our friend Mr. Fred Tepper, a careful and enthusiastic student and collector.

It differs materially from *S. rectifascia*, Grote, and from the two unidentified species figured by Hübner.

Heliothis lucens, nov. sp.

Expanse 27 mm. Length of body 14 mm.

All the tibiæ spinose, the anterior tibiæ with several strong claw terminal-like spines.

Thorax concolorous with the anterior wings; the latter are dark red, thickly overspread with bluish atoms, which give them a very singular and beautiful appearance; the ordinary lines are white, all very distinct and clear; the interior line perpendicular, strongly lobed between the nervules; the exterior line dentate, straight opposite the cell, below it strongly drawn in; subterminal line rivulous; fringe checkered, white and red.

Posterior wings yellow, with a broad central black basal spot and a very broad black terminal band; fringes white.

Beneath yellowish-white, with very distinct markings; on the anterior wings a black basal dash, two median black spots, corresponding to the orbicular and reniform spots, several bright red apical dashes and a broad black terminal band crossed by the light nervules; posterior wings with a conspicuous black discal dot and a double bright red terminal band, which changes before the anal angle into a single broad black band.

Hab. Mass., Nebraska.

Described from one specimen in the collection of the Boston Society of Natural History, and from one in our own collection received from Mr. G. M. Dodge.

This is one of the most beautiful species of a genus remarkable for its brilliant colors.

Tarache patula, nov. sp.

Expanse 15 mm. Length of body 7 mm.

Eyes naked. Clothing of the front and thorax close and scaly.

Form comparatively stout. Anterior wings triangular, with straight costal margin and pointed apices; in color they are light yellow, with ferruginous markings; the latter are very simple, they consist only of broad oblique ferruginous fasciæ; the first fascia extends from the inner margin, about one-third of the distance from the base to the inner angle, to the apex, it gradually decreases in breadth and at the apex becomes linear; the second fascia extends from a point on the inner margin, about two-thirds of the distance from the base to the inner angle, to the apex, it is of nearly equal breadth throughout; the terminal space is shaded with ferruginous.

Posterior wings yellowish, immaculate, except a ferruginous dash on the costa just before the apex of the anterior wings.

Hab. Texas. September 11.

We refer this little species provisionally to this genus; it differs from the typical species in the form of the wings and the peculiar character of the markings. We hesitate to found a new genus on a single specimen.

Tarache crustaria, nov. sp.

Expanse 26 mm. Length of body 12 mm.

Habitus and markings of the European *T. lucida* and *T. luctuosa*, and much larger and stouter than our native species, except *T. terminimaculata*, Grote.

Eyes naked. Legs long and slender, the tibiæ unarmed.

Front and thorax closely scaled as in the allied species. Anterior wings white, much shaded with black; a distinct basal black dash, around which the basal space is shaded with blackish; the ordinary spots are reduced to two distinct black dots; the median space is broad, white, crossed between the spots by a wide blackish band (representing the median shade) extending from the costa to the inner margin; the terminal and subterminal spaces blackish; the exterior line is only indicated by the contrast in color between the spaces; the subterminal line is white, rivulous, most distinct at the costa and internal angle; it is preceded by two small black blotches, one opposite the cell, the other between the second and third median nervules; a conspicuous black blotch at the apex; a series of black dots at the base of the white fringe. Posterior wings black, with indistinct discal dots and with a broad conspicuous white median band, extending from the abdominal margin two-thirds of the distance across the wings.

Beneath white, with discal dots, a narrow common median line and a broad suffuse common subterminal band.

Hab. Nebraska.

Described from material given us by Mr. G. M. Dodge.

This insect is separated from all the North American species of the genus by the black posterior wings, crossed by a single white band; in this particular it resembles the European *T. luctuosa*.

Lithacodia penita, nov. sp.

Expanse 23 mm. Length of body 10 mm.

Habitus and markings of *L. bellicula*, Hübner, to which it is closely allied; it differs in the following particulars: the interior line is strongly outwardly produced beneath the median nervure, the orbicular spot absent, the reniform pure white and very distinct, preceded by a dark brown shading; the exterior line is not followed by a white contrasting shade line as in *L. bellicula*, nor is it angulate beneath the cell; the subterminal line white, very clear at the costa, where it is preceded by a brown shade, below it contrasts with the dark brown terminal space; posterior wings uniform dark gray; beneath, both wings are gray, the posteriors have a median transverse line.

Hab. New York.

One female specimen received from Mr. Fred. Tepper. In this species the ovipositor protrudes, but it is partially concealed by the anal tuft.

L. penita and its ally are related to *Eustrotia* rather than *Jaspidea*.

Remigia texana, Morr.

Remigia var. texana Morr., Proc. Bost. Soc. Nat. Hist., vol. xvii. p. 219, 1874.

Since we published our description of this form we have received additional material, and now we think probable that it is distinct from the well-known *R. latipes*, Guen. The median lines are very plain, extending from border to border, and accompanied by lighter shade lines; the orbicular spot is reduced to a white dot; the reniform is black encircled, concolorous, from its base the double, wavy, median shade extends to the inner margin; a series of black subterminal dots.

Expanse 45 mm. *Hab.* Texas.

MARCH 2.

The President, Dr RUSCHENBERGER, in the chair.

Twenty-eight members present.

On Thin Sections of the Traps of the Mesozoic Basin.—Prof. FRAZER made the following remarks: The great mesozoic basin traverses York, Adams, Chester, and Montgomery Counties, in Pennsylvania, as well as New Jersey and New York, while detached portions are found in several of the New England States, in none of which are its characteristics more clearly defined than in Connecticut. During a recent visit to New Haven I had the privilege of examining the fine microscopic slides or thin sections which have been prepared by Mr. Dana from the traps of that region. It is of great interest to observe the striking resemblance of these rocks to our own from the same formation. To the eye and even under the magnifying glass they seem the same, whereas in fact they are of, at least, two different kinds.

One kind, which has been described on several occasions before the Academy as that forming the Seminary Ridge near Gettysburg, is a greenish-gray compact dolerite (projected by me on the screen by means of the gas microscope, at a previous meeting), which, under higher magnifying power, shows white tablets of plagioclastic felspar and green crystals of pyroxene, with some chrysolite (olirine).

Far different is the rock which has been previously referred to as Syenite, and which has an apparently similar representative near New Haven. Under the microscope, however, the coarse rock from New Haven resembling the others from that locality in everything but texture, differs materially from the specimen from Gettysburg.

Since my return home I have examined two or three other slides of the Gettysburg rock, and find no essential difference between them. They contain hornblende and quartz; the others do not. The constituents of the coarse rock from both States were pyroxenite, plagioclase, magnetite, some chrysolite, some bictite, and rarely quartz.

The investigations of the last week have led me to query the occurrence of prehinite in this rock which I reported at the last meeting. But these questions will be settled very soon.

The death of Rev. Henry S. Spackman was announced.

March 9.

The President, Dr. Ruschenberger, in the chair.

Eighteen members present.

The Feet of Bathmodon.—Prof. Cope described the structure of the feet in *Bathmodon.* He pointed out the existence of five digits on each of the feet, composed of very short metapodial and phalangeal bones. The carpus resembles that of the Toxodonts as described by Prof. Burmeister, but differs in the much greater ulno-carpal articulation. The carpus differs from that of the Proboscidia in the considerable mutual articulation of the unciform and lunar bones. The tarsus more nearly resembles that of the Proboscidians, but differs in the abbreviation of the navicular bone, on the inner side. This abbreviation permits the cuboid, which is wide as in the Elephants, as well as the ectocuneiform, to come in contact with the astragalus. On these grounds, the genus *Bathmodon*, and probably *Coryphodon*, Owen, which is nearly allied to it, were separated as a distinct order from the *Proboscidia*, under the name of *Amblypoda*, and two suborders were recognized, viz.: *Pantodonta*, represented by *Bathmodon*, and *Dinocerata*, represented by *Uintatherium* and *Loxolophodon.*

The death of Dr. G. W. Norris was announced.

March 16.

The President, Dr. Ruschenberger, in the chair.

Thirty-one members present.

Remarks on some Marine Rhizopods.—Prof. Leidy remarked that he had spent a short time last August at Noank, on the coast of Connecticut, where Prof. Baird was then engaged in pursuing his inquiries and investigations as United States Commissioner of Fisheries. Through the kindness of Prof. Baird he had been enabled to make a few observations on some marine Rhizopods.

Some years ago, on the beach at Newport, R. I., he had noticed that the ripple marks of the sand were crested with white particles, which could be scraped up by the handful, and which he at first viewed as the pulverized debris of various calcareous shells. On closer examination the material was found in large proportion to consist of the dead shells of Foraminifera. The immense quantities of these remains, extending in innumerable ridges over the broad expanse of the beach, had led him to suspect that he would find them living in the greatest profusion in the dredgings off the coast of Noank. In this view he had been disappointed, though many living individuals were obtained in dredging, adhering to hydroids, sponges, and the roots of fuci. The number of species observed was small, though the individuals of several of them were numerous. In the best condition, and especially abundant, were two Foraminifers, a Miliola, and a Rotalia, exhibiting some variety of form.

The Miliola resembles the *Quinqueoculina meredionalis* of Dorbigny, and is probably the same species. The shell, from $\frac{1}{8}$th to $\frac{1}{6}$th of a line in breadth, is white and more or less translucent, or is colorless and transparent. It exhibits five compartments or cells, in the mouth of the last and largest of which there is a blunt, conical tooth. The interior soft structure was yellowish-brown, or pinkish-brown, darkest in the smallest cell, successively lighter in the others, and sometimes nearly colorless in the last or largest cell. In the last cell, and less frequently in the second cell, the soft matter exhibited many globules of transparent, colorless liquid. In the active condition the animal protruded a multitude of exceedingly delicate pseudopods, which, radiating from the mouth, ramified and frequently anastomosed in the most intricate manner, as usual among Foraminifers.

The Rotalia is a beautiful, spiral, many-chambered shell, from the $\frac{1}{10}$th to the $\frac{1}{6}$th of a line in breadth, and strongly resembles the *Rosalina varians*, as represented in Figure 8, Plate III. of Schultze's Polythalamien. The shell is white and more or less translucent, and is composed of from twelve to eighteen cells. The soft structure within is dark-reddish or yellowish-brown in the smallest cells, light brown or yellowish in the larger cells, and faintly yellowish or colorless in the largest cells. Pseudopods radiated everywhere from the minute pores of the shell.

A few Polythalmous shells were observed, which appeared to be composed of particles of sand cemented in the same manner as in the fresh-water Difflugians. One of them was a spiral shell like a Rotalia, composed of eighteen cells, and measuring about $\frac{1}{7}$th of a line in breadth. The soft structure within the smallest cells appeared to be amber-brown.

Another of these arenaceous shells resembled in its shape and the alternation of the cells the *Textilaria agglutinans* of Dorbigny, of the West Indies. A specimen of thirteen cells was about the $\frac{1}{10}$th of a line long by $\frac{1}{16}$ of a line at the broad end. The soft structure was reddish-brown within the smallest cells, becoming successively lighter in the larger cells, until in the last or largest it was colorless, or nearly so.

A third form consisted of a straight or slightly bent series of cells, for the most part oblate spheroidal, and successively increasing in size. The first cell is globular and larger than the few succeeding ones. The last or largest cell is more of a conical form. The interior structure was faintly yellowish or nearly colorless. A specimen of eighteen cells was $\frac{1}{4}$th of a line long, with the last cell about $\frac{1}{20}$th of a line in diameter.

An interesting Rhizopod, not pertaining to the Polythalamous foraminifers, to which my attention was directed by Prof. Verrill, frequently occurred in the mud dredged off the Connecticut coast.

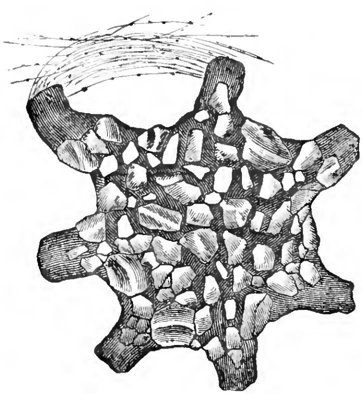
The same creature is referred to by Prof. Verrill in the Report of the Commissioner of Fish and Fisheries for 1871 and 1872, page 503, as being extremely abundant in the clear siliceous sand dredged from Vineyard Sound.

The creature was discovered by Dr. Sandahl in the Bohnslaüs Archipelago, and is described in the Ofvers. K. Vetensk. Ak. Forh., Stockholm, 1857, 301, under the name of *Astrorhiza limicola.* It is also referred to in Thomson's "Depths of the Sea," p. 75, as occurring in the Atlantic ooze off the Faroe Isles.

The case of this Rhizopod is constructed of angular particles of quartz-sand, cemented by tenacious matter mingled with the finest dark-colored mud. The body of the case is discoid or lenticular, with a number of short cylindroid processes radiant from the margin, giving the case altogether an irregular stellate form, as represented in the accompanying wood-cut.

Sandahl describes the shell as exhibiting scattered yellowish-brown spots, unequal, irregular, and somewhat shining. These spots, in the specimens examined by me, are due to the translucent quartz particles through which the yellowish color of the interior soft structure of the animal is seen. Sandahl gives the number of radii from 10 to 15, and the size of the case from 3 to 4 lines. Our specimens measured from $2\frac{1}{2}$ to 4 lines, and exhibited radii from 6 to 13 in number.

The interior soft substance of the little mud stars is a viscid, mucoid matter. The ectosarc is colorless. The entosarc was granular and yellowish, sometimes containing ova-like bodies, with darker yellow or orange-colored contents. Besides these the entosarc contained clear globules and a multitude of diatomes, principally a species of Coscinodiscus.



Astrorhiza limicola, magnified 10 diameters.

I failed to see the Astrorhiza in a very active condition, probably from the hot summer weather too quickly giving rise to decomposition in the material collected. Only in two instances did I discover the animal with a number of delicate filamentous pseudopods projected from the processes of the disk. The pseudopods as seen, and as represented by Sandahl, are like those of the Foraminifera.

In the single-chambered character and structure of the case, Astrorhiza resembles the fresh-water Difflugia, but differs in having many orifices, to protrude the pseudopods, instead of a single one.

Notes on the Character of the Lower Silurian Slate at their Outcrops.—Prof. FRAZER remarked that a fine-grained hydromica slate from a point on the Peach Bottom Railroad, about five miles from York, had been submitted to Dr. GENTH for an investigation of the amount of its alkaline constituents.

The specimen was of greenish-gray color and semi-unctuous lustre, and contained, in a chloritic mass, fine scales of mica, and exceedingly fine particles of a mineral of apparently metallic lustre.

The water gave	. . . .	2.36 per cent.
Potash "	. . . .	1.05 "
Soda "	. . . .	0.75 "

With a decided trace of lithia (possibly from contained Lepidolite).

Dr. Genth adds, "Taking the potash as belonging to Damourite, we should have nearly 9 per cent. of it; and the soda to paragonite there would be 9.6 per cent."

The mass of this rock is chloritic while the small speck of pearly mica-like mineral might be Euphyllite, or (in view of the per cent. of Li) Cookeite. In the former case both the K and Na would be associated together in the same constituent, while the Li would remain unaccounted for. Vogtite, Margarodite, or the species examined by Smith & Brush, from Litchfield, Connecticut, and which was intermediate between Margarodite and Paragonite, might be represented.

But the plan proposed by J. D. Dana, of characterizing these partially decomposed slates simply as hydro-mica slates, seems to fulfil every requisite of accuracy.

MARCH 23.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

The following papers were presented for publication :—

"On Buteonine Subgenus Craxirex, Gould." By Robert Ridgway.

"On Nisus Cooperi, Bonaparte, and N. Gundlachi, Lawrence." By Robert Ridgway.

MARCH 30.

The President, Dr. RUSCHENBERGER, in the chair.

Sixty-four members present.

Jacob P. Jones, George Cochran, H. C. Lewis, Wm. G. Castle, James S. Mason, Miss Rebecca Gibson, and Mrs. Caroline G. Taitt, were elected members.

The Committee to which they had been referred recommended the following papers to be published:—

ON NISUS COOPERI (BONAPARTE), AND N. GUNDLACHI (LAWRENCE).

BY ROBERT RIDGWAY.

Nisus Cooperi.

Falco cooperi, Bonap., Am. Orn. I. 1828, pl. 10, fig. 1; Ann. N. Y. Lyc. II. 433; Isis, 1832, 1137. Jameson, (ed. Wils.) Am. Orn. IV. 1831, 3. Peab. B. Mass. III. 1841, 78.—*Astur cooperi*, Bonap., Comp. List, 1838, 5. R. Z. 1850, 489. Consp. I. 1850, 31. Jard. (ed. Wils.) Am. Orn. 1840, 651.—*Accipiter cooperi*, Dekay, Zool. N. Y. II. 1844, 18, pl. iv. f. 5. Gray, List Ac. B. M. 1848, 38. Gen. B. I. 1849, 29. Hand List, I. 1869, 32. Cass. B. Cal. Tex. etc., 1854, 96; B. N. Am. 1858, 16. Heerm. Pac. R. R. Rep. VII. 1857, 31. Newb. Ib. VI. iv. 1857, 74. Max. Cab. Journ. VI. 1858, 13. Baird, Cat. N. Am. B. 1859, No. 15. Brewer, N. Am. Oölogy, I. 1857, 20, pl. v. f. 55. Scl. P. Z. S. 1859, 389. Coop. & Suckl. P. R. R. Rep. XII. ii. 1860, 145. Blakist. Ibis, 1861, 317. Dresser, Ibis, 1865, 323. Coues, Pr. A. N. S. Phila. 1866, 43; Key to N. Am. B. 1872, 212; Check List N. Am. B. 1873, 67. Scl. & Salv. Ex. Orn. I. 1869, 170 (foot note); Nom. Neotr. 1873, 129; Gray, Hand List. I. 1869, 170; Ridgw. Pr. A. N. S. Phila. 1870, 141; B. N. W., 1875, 334. Adams, Rambles, 1873, 297. Sharpe, Cat. Acc. B. M. 1874, 137.—*Nisus cooperi*, Schl. Rev. Acc. 1873, 73. Ridgw. Cat. Falc. Mus. Boston Soc. May, 1873, 19; B. B. & R. Hist. N. Am. B. III. 1874, 230.—*Falco stanleyi*, Aud. B. Am. 1831, pls. 36, 141; Orn. Biog. I. 1831, 186.—*Cooperastur stanleyi*, Bonap. Rev. et Mag. Zool. 1854, 538.—*Accipiter mexicanus*, Swains. F. B. A. II. 1831, 45. Jard. (ed. Wils.) Am. Orn. II. 1832, 215. Bonap. Consp. I. 1850, 32 (sub A. fuscus). Cass. B. Cal. Tex. etc. 1854, 96; Pr. A. N. S. Phila. 1855, 279; B. N. Am. 1858, 17. Strickl. Orn. Syn. I. 1855, 109. Coop. & Suckl. Pac. R. R. Rep. XII. ii. 1860, 146. Coues, Pr. A. N. S. Phila. 1866, 43. Gray, Hand List, I. 1869, 33. Cooper, Orn. Cal. I. 1870, 465.—*Nisus cooperi* var. *mexicanus*, Ridgw. Cat. Falc. Mus. Boston Soc. May, 1873, 19; B. B. & R. Hist. N. Am. B. III. 1874, 231.—"*Accipiter pileatus*," Strickl. Orn. Syn. I. 1855, 109 (in part—not *A. pileatus* Vig. 1824).—*Northern Falcon*, Lath. Gen. Synop. I. 1781, 79, No. 62 (♀ ad.).—*Falco hyemalis*, β. Gmel. S. N. I. 1788, 274 (♀ ad.).

Habitat.—United States, and table-lands of Mexico; southward (in winter) to Costa Rica and Veragua; north (in summer), to New Brunswick, the Saskatchewan, and Washington Territory.

Diagnosis.—Wing, 8.70–11.00; tail, 7.80–10.50; culmen, .58–.80; tarsus, 2.30–2.85; middle toe, 1.45–1.85. Fourth or fifth quill longest; first equal to or shorter than tenth; outer five with inner webs sinuated. Tail rounded. Tarsi distinctly scutellate.

Adult.—Above slate-color, varying from a fine bluish to a brownish cast, the shafts of the feather black. Pileum plumbeous-black, the occipital feathers snow-white beneath the surface; primaries plain brownish-slate, their shafts clear brown. Tail narrowly tipped with white, and crossed by four very regular, but sometimes not sharply defined, bands of dusky, usually rather narrower than the slaty ones—the last broadest, the first nearly obsolete, and concealed by the coverts, which are sometimes narrowly tipped with white. Lower parts white and rufous, in transverse bars, the shafts of the feathers black, and the rufous bars usually connected along the middle portion of the feathers; tibiæ more deeply colored, the rufous usually predominating; crissum immaculate white. Lining of the wing white, irregularly spotted with deep rufous; inner webs of the primaries with transverse bands of dusky and white anterior to their emargination and silvery-gray terminally—the dusky bands about seven in number on the longest quill, the two colors nearly equal in width. Bill black terminally, pale blue basally; cere greenish-yellow; iris orange-red; tarsi and toes lemon-yellow; claws black. Male: Slate of the upper parts of a fine bluish cast; nape and sides of the head bluish-ashy, the sides of the breast usually tinged with the same. Wing, 8.85–9.40; tail, 7.80–8.30; culmen, .60–.68; tarsus, 2.30–2.60; middle toe, 1.45–1.55. (Eight specimens.) Female: Slate of the upper parts of a brownish cast; nape and sides of the head dull rusty rufous, the sides of the breast without ashy tinge. Wing, 10.10–10.80; tail, 9.00–9.40; culmen, .70–.80; tarsus, 2.65–2.85; middle toe, 1.60–1.85. (Five specimens.)

Young: Above grayish-brown, the feathers more or less bordered with rusty; the scapulars and upper tail-coverts with concealed white spots; the occiput blackish, with the bases of the feathers white; and the pileum and nape streaked with rusty. Tail grayish-brown, tipped with whitish, and crossed by four bands of brownish-black or dusky. Lower parts white, longitudinally striped with clear dusky brown; the shafts black. Iris varying from greenish-white to chrome-yellow; bill blackish terminally, pale blue basally; tarsi and toes varying from very pale greenish-yellow to lemon-yellow; claws slate-black.

Remarks.—The extent of individual variation in this species, though very considerable, is limited by the terms of the above diagnosis. Adult males vary as follows:—

No. 10,086, locality unknown (type of description of *N. cooperi, adult male*, in Baird, Brewer, and Ridgway's History North American Birds, vol. III. p. 230): Forehead, crown, and occiput blackish-plumbeous, the latter snowy-white beneath the surface; rest of upper parts slaty-plumbeous, the nape abruptly lighter than the occiput; feathers of the nape, back, scapulars, and rump with darker shaft-lines; scapulars with concealed cordate and circular spots of white; upper tail-coverts sharply tipped with white. Tail more brownish than the rump, sharply tipped with pure white, and crossed with three broad, sharply defined bands of black, the first of which is concealed, the last much broadest; that portion of the shaft between the two exposed black bands white. Lores grayish; cheeks and throat white, with fine, hair-like, shaft-streaks of blackish; ear-coverts and sides of neck more ashy, and more faintly streaked. Ground-color beneath pure white, but broken by detached transverse bars of rich vinaceous-rufous, crossing the jugulum, breast, sides, flanks, abdomen, and tibiæ; the white bars everywhere (except on sides of the breast) rather exceeding the rufous in width; all the feathers (except tibial plumes) with distinct black shaft-lines; lower tail-coverts immaculate pure white. Lining of the wing white, with numerous cordate spots of rufous; under wing-coverts with transverse blackish bars; under side of primaries silvery-white, purest basally (tips dusky), crossed with quadrate bars of dusky, of which there are six (the first only indicated) upon the longest quill (fourth). Wing, 9.35; tail, 8.30; culmen, .68; tarsus, 2.45; middle toe, 1.55. Fourth quill longest; third shorter than fifth; second intermediate between sixth and seventh; first, 2.80 shorter than longest; graduation of tail, 1.00.

No. 12,024, Ft. Tejon, Cal.; J. Xantus (type of description of var. *Mexicanus, adult male*, in Hist. N. Am. Birds, III. p. 231): Forehead, crown, and occiput plumbeous-black, feathers of the latter with basal two-thirds snowy-white, partially exposed. Upper plumage deep plumbeous, darkest anteriorly, the back being scarcely lighter than the nape; rump fine bluish-plumbeous. No concealed white on the upper parts. Tail brownish-plumbeous, narrowly tipped with pure white, and with four sharply defined broad bands of black, the first of which is faintest, and concealed by the coverts, the last broadest; shafts of tail-feathers deep brown throughout. Primaries and secondaries much darker than the tail, more bluish; less so, however, than the scapulars. Lores whitish, quite in contrast with the black of the forehead; cheeks and ear-coverts dark-ashy, slightly washed with reddish, and with obscure darker streaks; chin and throat white, with sparse, hair-like shaft-streaks of black. Breast, abdomen, sides, flanks, and tibiæ fine vinaceous-rufous, the feathers (except on tibiæ) with fine hair-like shaft-streaks of black; breast, abdomen, sides, and flanks with pairs of transverse ovoid white spots, not touching the shaft; on the abdomen the white and rufous bars are of about equal width; on the tibiæ the rufous is deepest, and exceeds the white; anal region barred with rufous, more faintly than the abdomen; lower tail-coverts immaculate snowy-white. Sides of the neck deep reddish-ashy, this washing the whole side of the breast. Lining of the wing reddish-white, with numerous crowded, cordate, somewhat blended spots of rufous; larger coverts transversely spotted with blackish; under side of primaries silvery-white (blackish for about the terminal inch), crossed with quadrate spots of blackish, of which there are about seven on the longest quill (fourth); the basal ones are, however, so much broken, that the number is rather indefinite. Wing, 9.10; tail, 8.20; culmen, .65; tarsus, 2.60; middle toe, 1.50.

No. 66,237, Westfield, Massachusetts, October 10, 1846. Very similar to the preceding (No. 12,024), but even darker, the rufous of the lower parts deeper, and the ashy tinge on the side of the breast still stronger. Wing, 9.20; tail, 8.15; culmen, .65; tarsus, 2.55; middle, 1.50.

No. 6,874, Sacramento Valley, California, differs from the two preceding in having the entire breast barred with rufous and white, instead of having the two sides ashy, the white bars restricted to the middle line; the black of the pileum terminates abruptly on the occiput, and the sides of the neck are tinged with rusty, as in females. Wing, 9.30; tail, 8.15; culmen, .60; tarsus, 2.45; middle toe, 1.50. It resembles No. 10,086, except that the colors are uniformly of a darker shade throughout.

No. 2,554 (Mus. R. R.), Washington, D. C., differs from No. 10,086, in paler colors, and more delicate shades; the sides of the breast have a distinct wash of pearly-ash, while the nape is pale bluish-ash, lighter than the back, and abruptly defined against the dark plumbeous crown. Wing, 9.40; tail, 8.30; culmen, .65; tarsus, 2.50; middle toe, 1.55.

No. 42,074, Mirador, Mexico, is extremely similar to the last, except that it lacks the ashy tinge on the side of the breast. Wing, 8.85; tail, 7.80; culmen, .65; tarsus, 2.40; middle toe, 1.45. Another Mirador specimen (No. 23,809) is exactly similar; it measures: wing, 9.40; tail, 8.10; tarsus, 2.30; middle toe, 1.45—nearly the same as the Washington specimen.

No. 5,841, Puget Sound, October 4, is exactly similar to No. 6,874 (Sacramento Valley), and has, like it, the forehead strongly tinged with dull rusty. Wing, 8.90; tail, 8.00; culmen, .62; tarsus, 2.45; middle toe, 1.55.

The adult females differ pretty constantly from the males in the much browner upper parts, and rusty instead of ashy nape and auriculars—though this last feature is a less constant distinction.

No. 26,588, Washington, D. C. Similar to the male, but the upper parts lacking entirely any bluish cast, and the rufous of the lower parts less vinaceous in tint. Forehead tinged with rusty brown; neck and auriculars uniform dull rufous, with a rusty brown tinge, and sides of the breast entirely destitute of ashy wash. Wing, 10.80; tail, 9.00; culmen, .75; tarsus, 2.65; middle toe, 1.85; fourth and fifth quills equal and longest; third longer than sixth; second intermediate between sixth and seventh; first, three inches shorter than the longest.

No. 57,867, Tehuantepec, S. Mexico (January 8, 1869), is exactly like No. 26,588, except that the tibiæ are deeper, and nearly uniform, rufous. Wing, 10.35; tail, 9.40; culmen, .70; tarsus, 2.80; middle toe, 1.70.

No. 55,018, Mazatlan, W. Mexico (February 21), differs in having the rufous bars of the lower parts browner, more sharply defined, and more regularly transverse. Wing, 10.10; tail, 9.30; culmen, .75; tarsus, 2.65; middle toe, 1.60.

Two other specimens (No. 5,792, South Carolina, and No. 49,682, Arizona) are very similar in colors to the last; their measurements may be found in the appended table:—

The following detailed descriptions of young birds are of specimens typical of the two styles:—

Young male (55,498, Fort Macon, N. C., February; Dr. Coues, type of var. *Cooperi* in Hist. N. Am. Birds, III. p. 231): Above grayish-umber, the feathers of forehead, crown, and nape faintly edged laterally with pale rusty; occiput unvaried blackish, feathers white beneath the surface. Wing-coverts, scapulars, and interscapulars narrowly bordered with pale yellowish-umber; rump and upper tail-coverts bordered with rusty. Tail paler umber than the back, narrowly tipped with white, and crossed by four bands of brownish-black, the first of which is only partially concealed. Scapulars and upper tail-coverts showing much concealed white, in form of roundish spots, on both webs. Beneath clear white, without any yellowish tinge; throat with a medial and lateral series of clear dark-brown streaks; jugulum, breast, sides, flanks, and abdomen, with numerous stripes of clear sepia, each showing a darker shaft-streak; tibiæ with longitudinal streaks of paler and more rusty brown; lower tail-coverts immaculate.

Young female (6876 "Sacramento Valley, Cal.;" Dr. Heermann —probably from Pennsylvania, type in Hist. N. Am. B., III. p. 231): Similar to young male; more varied, however. The black middle streaks of feathers of head above narrower, causing more conspicuous streaks; white spots of scapular region considerably exposed; longitudinal stripes beneath narrower and more sparse.

Young male (Fort Tejon, California, type of var. *Mexicanus*, *tom. cit.* 232): Forehead, crown, occiput, and nape, deep rusty-rufous; feathers with broad longitudinal streaks of pure black. Rest of upper parts deep umber, darkest on the back; feathers of back and rump, the upper tail-coverts, scapulars, and wing-coverts, broadly bordered with rusty; scapulars with concealed white spots. Tail ashy-umber, tipped (more broadly than in adult) with ashy-white, crossed by four broad bands of brownish-black; the last (or subterminal) of which is broadest, the first concealed by the coverts. Secondaries and primaries similar in color to the tail, but darker; the first showing five obsolete darker bands, and tipped (rather broadly) with pale cinnamon-rufous. Ear-coverts and cheeks fulvous-white, thickly streaked with dark brown. Lower parts white, washed with ochraceous on jugulum and breast; each feather with a central longitudinal lanceolate stripe of clear umber, the shaft of each black; these streaks are very narrow on the throat, broadest on the breast and flanks. Tibiæ with transversely ovate spots, and transverse bars of reddish-umber; lower tail-coverts with narrow shaft-streaks of darker brown. Lining of wing with cordate and ovate spots of dark brown.

Young female (42,136, Orizaba, Mexico; M. Botteri, type in

Hist. N. Am. B., 232): Similar to the young male; feathers of back, etc., less broadly margined with rusty. Ochraceous wash on lower parts more decided; stripes beneath broader and less lanceolate; on the sides broadly ovate, and on the flanks in form of broad transverse bars; tibiæ more thickly spotted transversely; lower tail-coverts immaculate. Wing, 9.00; tail, 7.80; tarsus, 2.25; middle toe, 2.50. Fourth quill longest; third shorter than fifth; second intermediate between sixth and seventh; first, 2.90 shorter than longest. Graduation of tail, .90.

Although occasional individuals from Mexico lead at first to the impression of a decided difference from the usual style of the eastern United States, they lose their apparently distinctive features when a large series is brought together for comparison. As a rule, adult males from Mexico agree with each other, and differ from the *average* style of the same plumage in birds from the eastern United States, in having the rufous of the lower parts in greater amount in proportion to the white, that of the tibiæ being often almost unbroken; there is usually also less of concealed white on the scapulars. The most typical example of the so-called *A. mexicanus*, however, is one from Massachusetts, described on p. 81. The climatic difference between eastern and western birds of this species is more marked in the young than in the adult plumage, however; and there seems to be great constancy in the differences observable. Thus, the western birds are darker colored throughout, the brown markings occupying larger areas, and the white portions of a less pure color, being more or less suffused, or stained with pale ochraceous. The markings on the tibiæ are almost always transversely-cordate spots instead of longitudinal streaks. This darker style of plumage is characteristic of the entire Western Province, east to the Missouri Plains; but along the southern border and in Mexico, birds more like the eastern style seem to prevail.

Upon the whole, it is found impossible to characterize by tangible, and, at the same time, constant characters, two geographical races of this species; for, while a barely appreciable difference characterizes the majority of the birds of either region, the cases of individuals which correspond in every particular being found in the region of which they are not typical are too numerous to warrant the consideration of the two extremes as strictly climatic. It remains, therefore, for us to better class these variations as of an individual nature; and this stand-point is well borne out by the results of careful measurements of specimens from various localities in North America. The following table of measurements shows conclusively that the variations in general size, and relative proportions of the parts, are purely individual.

Measurements of 39 Specimens of Nisus Cooperi, from various portions of North America.

Wing.	Tail	Culmen.	Tarsus	Middle Toe.	Cat. No	Museum.	Locality.
				ADULT MALES.			
9.35	8.30	.68	2.45	1.55	10,086	Nat. Mus.	———?
9.40	8.30	.68	2.50	1.55	2,554	R. R.	Washington, D. C.
9.20	8.15	.65	2.55	1.50	66,237	Nat. Mus.	Massachusetts.
9.30	8.15	.60	2.45	1.50	6,874	" "	Sacramento Val., Cal.
9.10	8.20	.65	2.60	1.50	12,024	" "	Fort Tejon, Cal.
8.85	7.80	.65	2.40	1.45	42,074	" "	Mirador, Mexico.
9.40	8.10	..	2.30	1.55	23,809	" "	" "
8.90	8.00	.62	2.45	1.85	5,841	" "	Puget Sound.
9.25	8.60	.60	2.35	1.55	1,593	Aiken	El Paso, Col.
9.20	8.00	.65	2.65	1.60	*a*. 15	Lawrence	New York.
9.10	7.90	.65	2.35	1.65	*b*. 15	"	" "
				ADULT FEMALES.			
10.80	9.00	.75	2.65	1.85	26,588	Nat. Mus.	Washington, D. C.
10.50	9.00	.80	2.85	1.85	5,792	" "	South Carolina.
10.40	9.40	.75	2.70	1.75	49,683	" "	Arizona.
10.10	9.30	.75	2.65	1.60	55,018	" "	Mazatlan, W. Mex.
10.35	9.40	.70	2.80	1.70	57,867	" "	Tehuantepec, S. Mex.
10.20	9.10	.70	2.60	1.62	1,612	Aiken	Colorado.
10.00	9.10	.70	2.70	1.62	1,654	"	"

Wing.	Tail.	Culmen.	Tarsus.	Middle Toe.	Cat. No.	Museum.	Locality.
				Young Males.			
9.40	8.20	.65	2.65	1.55	25,201	Nat. Mus.	Washington, D. C.
9.25	8.90	.65	2.65	1.65	58,340	" "	Jacksonville, Florida.
9.15	8.60	.60	2.65	1.60	55,498	" "	North Carolina.
8.90	8.30	.60	2.60	1.50	19,117	" "	Wyoming Ter.
9.00	8.80	.60	2.30	1.45	5,165	" "	Dakota Ter.
9.10	8.60	.60	2.45	1.45	5,847	" "	Washington Ter.
8.70	8.35	.60	2.40	1.45	4,590	" "	" "
8.90	8.50	.60	2.40	1.50	1,759	R. R.	Nevada.
9.00	8 30	.60	2.50	1.50	....	Nat. Mus.	Fort Tejon, S. Cal.
9.00	8.40	.60	2.55	1.52	628	R. R.	Cape St. Lucas.
9.30	8.30	.60	2.50	1.40	17,208	Nat. Mus.	" "
8.90	8.00	.60	2.40	1.50	17,209	" "	" "
9.45	8.80	.60	2.45	1.50	42,073	" "	Mirador, E. Mexico.
9.15	8.40	.58	2.35	1.45	33,554	" "	" "
8.80	8.70	.60	2.45	1.50	32,500	" "	Orizaba, "
9.15	8.80	.55	2.45	1.48	....	C. E. A.	El Paso Co., Colorado.
				Young Females.			
10.00	9.00	.72	2.70	1.70	38,255	Nat. Mus.	Nebraska.
10.70	9.80	.75	2.85	1.80	60,868	" "	South Illinois.
10.60	10.00	.80	2.85	1.85	955	R. R.	" "
10.50	9.80	.70	2.70	1.65	17,510	Nat. Mus.	Montana Ter.
10.50	9.80	.70	2.65	1.65	28,114	" "	N. California.

Material examined.—National Museum, Washington, 68 specimens; Academy of Natural Sciences, Philadelphia, 18; American Museum, New York, 3; Boston Society of Natural History, 4; Museum Comparative Zoology, Cambridge, Mass., 3; Mus. G. N. Lawrence, Esq., 9; W. S. Brewer, Esq., 1; R. Ridgway, 7. Total number of specimens examined, 113.

Nisus Gundlachi.

Astur cooperi, Lemb. Av. de la Isla de Cuba, 1850, 17. Caban. Journ. f. Orn., Nov. 1854.—*Nisus pileatus*, Lemb. Av. Cuba, Supplement.—*Astur pileatus*, Gundl. Journ. f. Orn., Nov. 1854.—*Accipiter gundlachi*, Lawr. Ann. N. Y. Lyc. VII. May, 1860, 252. Gundl. Rep., 1865, 224. Scl. and Salv., Ex. Orn. I. 170. Gray, Hand List, I. 33, No. 319. Sharpe, Cat. Ac. B. M., 1874, 137 (foot-note).—*Nisus cooperi* var. *gundlachi*, Ridg., B. B. & R. Hist. N. Am. B. III. 1874, 223.

Diagnosis.—Adult male: "Front, crown, and occiput sooty black; upper plumage dull bluish-ash, the feathers of the back with brownish margins; tail of the same color as the back, partly tinged with dull rufous, and crossed with four brown bars, three of which are imperfect, being but little developed on the outer webs, the outer bar, however, crosses both webs and is narrowly tipped with white. Quill feathers brown, having their shafts, as are also those of the tail feathers, reddish-brown; cheeks dusky ash; space forward of the eye pale dull rufous; a line of whitish feathers runs along the edge of the crown and extends over the eye; throat ashy-white, tinged with rufous; sides of the neck, upper part of the breast, and a band running to the hind-neck grayish-ash; lower portion of the breast and upper part of the abdomen rufous, the feathers very narrowly edged with dull white; lower part of the abdomen of a pale rufous, with transverse bars of dull white. Long feathers of the sides grayish-ash tinged with rufous and destitute of bars or spots; sides, just above the junction of the tail, plain rufous; thighs of a bright but rather pale rufous, the feathers having darker submarginal ends, terminating with very narrow edgings of dull white; under wing-coverts and axillars bright rufous barred with white. The feathers of the throat, breast, and sides have their shafts dark brown; upper tail coverts grayish-ash, lower white; bill horn-color, with a whitish mark on the tooth and also on the edge of the lower mandible near its base; legs greenish-yellow."[1]

"Length about 18 inches; wing from flexure $9\frac{3}{8}$; tail $7\frac{3}{4}$; tarsus $2\frac{3}{4}$." (Lawrence, l. c.)

Young male (41,129, Cuba, Dr. Gundlach): Above dark, blackish vandyke-brown, the feathers bordered inconspicuously with dark rusty; tail dull slate, narrowly tipped with ashy-white, and crossed with four broad bands of dusky, almost equal to the slate; beneath white, much tinged on breast and tibiæ with reddish-ochraceous; thickly striped with umber-brown, except on crissum, the streaks on throat narrow and cuneate, those on breast broad, and on sides changing into broad transverse spots or bars; tibiæ thickly spotted transversely with more reddish, nearly rufous, brown; larger lower tail-coverts with narrow shaft-streaks of black. Occiput showing much concealed white, the

[1] Dr. Gundlach (Lawrence, l. c. p. 7) adds: Cere and cheeks (*i. e.* orbits?) greenish yellow; feet pale yellow with a greenish hue; iris red; length 0.457; extent 0.807.

ends of the feathers deep black. Wing, 8.60; tail, 7.50; culmen, .68; tarsus, 2.50; middle toe. 1.70.

Young female (41,128, Cuba, Dr. Gundlach): Similar, but more thickly striped beneath, the dark markings about equalling the white in extent; whole sides with large transverse spots of umber, cuneate along shafts. Wing, 10.50; tail, 9.50.

Remarks.—In regard to its relationship to its nearest allies—*N. cooperi* and *N. pileatus*—Mr. Lawrence (l. c. p. 8) remarks: "A very marked feature in the adult of this species is the ash-color of the breast and sides, which does not exist at all in *cooperi;* the under surface is less marked with white than in that species; the thighs are of a nearly uniform rufous, which in *cooperi* are conspicuously barred with white; in the latter the under wing-coverts are white, with longitudinal spots of rufous-brown, whereas in *gundlachi* they are rufous barred with white. From *A. pileatus*, as figured in Pl. Col. pl. 205, it is also very different; the adult of that species has the top of the head dark slate, the upper plumage of a rather light slate-blue; wings, dark slate; tail, with four dark bands, whitish between; the under plumage pale whitish-blue; thighs, deep rufous; no appearance of bars on any part of the plumage; under tail-coverts, white; bill, bluish, under mandible yellow at the base; legs, yellow."

In the "History of North American Birds" (III. p. 223, foot-note), this species is considered to be a geographical race of *N. cooperi;* and Mr. Sharpe, in his great work the "Catalogue of the Accipitres, or Diurnal Birds of Prey, in the collection of the British Museum" (p. 137, foot-note), remarks that it "will probably prove on examination to be identical with the small, richly-colored form of *A. cooperi*, called by Swainson *A. mexicanus.*" We have shown before that the latter is not entitled to recognition as even a race, though we had previously accorded it that rank, while Mr. Sharpe (*tom. cit.*, p. 137) more properly places it among the synonyms of *N. cooperi.* In regard to the *N. gundlachi*, the erroneous conclusions of both authors were the result of lack of specimens for comparison, and too hasty examination of published descriptions. The description of the adult, copied from the original paper by Mr. Lawrence (Annals of the Lyceum of Natural History of New York, VII., May, 1860, p. 252), shows clearly the perfect distinctness of the Cuban species from its North American ally, as well as from all other species of the genus.

ON THE BUTEONINE SUBGENUS CRAXIREX, GOULD.

BY ROBERT RIDGWAY.

The genus *Buteo* as restricted[1] is divided primarily into two very distinct groups, one (typical *Buteo*) having four and the other (*Craxirex*) having only three of the outer primaries emarginated on their inner webs. The European *B. vulgaris*, Leach, the type of the genus, belongs to the first group; its American allies are *B. borealis* (Gm.), *B. harlani* (Aud.), *B. cooperi*, Cass., *B. lineatus* (Gm.), *B. abbreviatus*, Caban., *B. minutus*, Pelz., and *B. brachyura*, Vieill.; while the Old World contains more numerous representatives of the subgenus.[2] The subgenus *Craxirex* is peculiar to America, the majority of the species belonging to the southern continent. North America possesses only *C. swainsoni*, Bonap.,

[1] At present we exclude from the genus *Buteo* the closely related forms named respectively *Heteraëtus*, Kaup (type *Spizaëtus melanoleucus*, Vieill.), *Urubitinga*, Lafr. (type *Falco urubitinga*, Gm. = *U. zonura* [Shaw]), *Heterospizias*, Sharpe (type *Falco meridionalis*, Lath.), *Antenor*, Ridgw. (type *Falco unicinctus*, Temm.), *Buteogallus*, Less. (type *Falco æquinoctialis*, Gm.), *Leucopternis*, Kaup (type *Falco melanops*, Lath.), *Asturina*, Vieill. (type *Falco nitidus*, Lath.), *Rupornis*, Kaup (type *Falco magnirostris*, Gm.), *Onychotes*, Ridgw. (type *O. gruberi*, Ridgw.), *Urubitornis*, Verr. (type *Circaëtus solitarius*, Tschudi), and *Harpyhaliaëtus*, Lafr. (type *Harpyia coronata*, Vieill.). *Busarellus*, Lafr. (type *Falco nigricollis*, Lath.), placed in most of the systems in close proximity to *Buteogallus*, and often in the same genus, we consider to be far removed from any of the above genera, being more closely related to the Haliaëtine forms, especially to *Gypoictinia*, Kaup (type *Buteo melanosternon*, Gould), of Australia.

[2] The synonymy of this subgenus is as follows:—

Buteo, Cuvier, Leç. Anat. Comp. I., tabl. Ois. 1800 (type, *Falco buteo*, Linn., =*B. vulgaris*, Leach).

Butaquila, Hodgs.,Gray's Zool. Misc. 1844, 81 (type, *Falco ferox*, Gm.).

Buteola, Bonap., Comp. Rend. XLI., 1855, 651 (type, *Buteo brachyura*, Vieill.).

Pterolestes, Sund., Disp. Ac. Hemeroharp., 1874, 23 (types, *Falco jakal*, Daud., and *Buteo augur*, Rupp.).

B. (*Craxirex*) *Swainsoni* has been usually regarded as the American analogue of the *B. vulgaris*, of Europe; but *B. lineatus* is, in reality, the nearest New World relative of the latter, agreeing very closely in size, proportions, and details of structure, though very different in color. *B. borealis* is also strictly congeneric with these two typical species.

and *C. pennsylvanicus* (Wils.), except in the southern portion; but Middle and South America have in addition to these (which are there winter migrants from the north), *C. albicaudatus* (Vieill.), *C. erythronotus* (King), *C. poliosomus* (Quoy and Gaim.), and *C. galapagoensis*, Gould.

Among the species composing the subgenus *Craxirex* there is considerable variation in proportions and size, though nothing of greater than specific importance, since no two are exactly alike in the details of form. *C. swainsoni* and *C. albicaudatus* have very long wings, reaching nearly to the end of the tail; but the latter has a conspicuously longer and thicker tarsus than the former; *C. erythronotus* agrees wonderfully with *C. albicaudatus* in its colors and changes of plumage, but in form it is intermediate between that species and *C. poliosomus*. On the other hand, there is quite a contrast between the great *C. galapagoensis* and the little *C. pennsylvanicus:* still, in the subgeneric character of only three primaries emarginated, even tail, etc., they all strictly agree. Several names have been invented to designate these variations of form, but they are not admissible. The synonymy of the subgenus stands as follows:—

Craxirex, Gould, Darwin's Voyage of the Beagle, Birds, 1841, 22 (type, *Polyborus galapagoensis*, Gould).

Tachytriorchis, Kaup, Classif. Saüg. Vog., 1844, 143 (type, *Falco pterocles*, Temm., = *Buteo albicaudatus*, Vieill.).

Pœcilopternis, Kaup, Isis, 1847, 329 (type, *Falco pennsylvanicus*, Wilson).

Authors have been exceedingly inconsistent in regard to the classification of the American *Buteones*. Thus, one of our latest and best authorities, Mr. Sharpe,[1] places *C. albicaudatus* and *Buteo abbreviatus* together in the so-called genus "*Tachytriorchis*" (= *Craxirex*, Syn.), composed, according to his arrangement, solely of these two species. The latter of these, however, belongs to the group having four primaries emarginated, and is, consequently, and for other reasons, a true *Buteo*. The incongruity of arrangement is still further increased by the placing of *C. galapagoensis*, *C. poliosomus*, *C. erythronotus*, *C. albicaudatus*, *C. swainsoni*, and *C. pennsylvanicus* in the genus *Buteo* (as separated from "*Tachytriorchis*"), and scattered among species of no

[1] Catalogue of the Accipitres, or Diurnal Birds of Prey, in the collection of the British Museum. By R. Bowdler Sharpe, London, 1874.

near affinity, while *Heteraëtus melanoleucus* (Vieill.) heads the list! Messrs. Sclater & Salvin, in their "Nomenclator Avium Neotropicalium"[1] (pp. 118–119), include all the species of *Buteo* and *Craxirex* in the genus *Buteo*, with the exception of *B. brachyura*, which is assigned to the special genus "*Buteola*," a procedure which is entirely unwarranted by the characters of the bird. Mr. Gray, in his "Hand List of Birds"[2] (I., pp. 6–9), makes the distinction between the subgenus *Buteo* (as he restricts it) and its allies strictly a geographical one, no true *Buteo* belonging, according to his classification, to the American continent. The subgenus *Craxirex* is made to include, besides the appropriate species, *Buteo borealis*, *B. lineatus*, *B. cooperi*, and *Antenor unicinctus!* The subgenus "*Tachytriorchis*" contains *B. leucops* (= *C. galapagoensis*, juv.), *B. abbreviatus* (given in the list as "63 *albonotatus*" and "65 *zonocercus*"), besides *B.* "*pterocles*" (= *albicaudatus*), *B. erythronotus*, and *B. poliosomus*, which are true *Craxireces.*

Having thus explained the proper limits of the subgenus *Craxirex*, I now present a synopsis of the species, briefly showing the distinguishing characters of each.

Synopsis of Species.

A.—Wing very long, the tips of the primaries reaching nearly or quite to the end of the tail. Tail of young crossed by very numerous (eleven to seventeen) very narrow and indistinct bars of dusky. Size, large (wing more than 12.00 inches).

a. Tail of adult grayish-brown, tipped with fulvous, and crossed with thirteen bars of blackish.

1. *C. galapagoensis.* Bill very large, much elongated, with its horizontal outlines nearly parallel. Adult. Sooty-black, the primaries glossed with ashy and barred with blackish-brown, and the lining of the wing tinged with rufous. Wing, 15.15–17.30; tail, 9.20–11.00; culmen, 1.25; tarsus, 2.65–3.35; middle toe, 2.10. *Hab.* Galapagos Islands.

b. Tail of adult white, crossed by narrow lines of slate-gray and with a very broad subterminal band of slate-black.

2. *C. poliosomus.* Bill smaller, less elongated, and with the upper outline more ascending basally. Adult. Bluish-slate; lores whitish; tail-coverts white, barred and mottled with

[1] London, 1873. [2] London, 1869.

slate; secondaries slate-gray, tipped with white. Wing, 15.00–18.10; tail, 9.00–10.50; culmen, 1.00; tarsus, 3.25–3.55; middle toe, 1.50–1.90. *Hab.* Chile, Patagonia, Tierra del Fuego, and Falkland Islands.

3. *C. erythronotus.* Adult. Above plumbeous, below white. ♂. Above entirely uniform plumbeous. ♀. Back and scapulars bright rufous. Wing, 14.25–18.50; tail, 7.30–10.00; culmen, .80–.100; tarsus, 2.95–3.50; middle toe, 1.30–1.50. *Hab.* From Peru southward along the Pacific slope of South America to the Falkland Islands.

4. *C. albicaudatus.* Adult. Above dark plumbeous; rump and lower parts white; throat, plumbeous-black. ♂. Lesser wing-coverts with a very restricted patch of rufous along the anterior edge; longer scapulars, distinctly tinged with rufous. ♀. Rufous patch on lesser coverts extended over nearly the whole area of the region; longer scapulars scarcely tinged with rufous. Wing, 14.50–18.50; tail, 5.50–10.50; culmen, .95–1.05; tarsus, 3.30–3.70; middle toe, 1.55–1.80. *Hab.* Eastern South America, from Paraguay to Columbia; both sides of Middle America, from Panama northward to Colima, City of Mexico, and Mirador.

c. Tail grayish-brown, sometimes with a hoary cast, crossed by about nine or ten very indistinct narrow bars of dusky.

5. *C. swainsoni.* Above nearly uniform dusky-brown; beneath sometimes wholly uniform dark chocolate-brown, or sooty-brown, but usually with a white throat patch, a uniform brown (♀) or rufous (♂) pectoral area, behind which the ground color is lighter, usually with transverse bars or spots of darker shades of brown or rufous. Wing, 12.00–17.25; tail, 8.00–9.80; culmen, .80–.95; tarsus, 2.30–2.90; middle toe, 1.40–1.70. *Hab.* North America, except the eastern forest district; in winter migrating southward through Middle and South America as far as Patagonia.

B.—Wing short, the tips of the primaries reaching only to the middle of the tail. Tail of young crossed by only five to seven wide bars of dusky. Size small (wing less than 12.00 inches).

d. Tail of adult black, crossed by two to four wide bands of light brownish-gray or brownish-white (the last broadest) and narrowly tipped with white.

6. *C. pennsylvanicus.* Adult. Above nearly uniform dusky-brown, darker on the back; below dull rufous-brown, much broken, especially posteriorly, by transverse spotting of white. Wing, 9.85–11.40; tail, 6.50–8.00; culmen, .70–.78; tarsus, 2.15–2.80; middle toe, 1.20–1.40. *Hab.* Eastern Province of North America, and Cuba; in winter migrating southward through West Indies and eastern Middle America to upper Amazonia and Columbia.

1. **Buteo (Craxirex) galapagoensis.**

Polyborus galapagoensis, Gould, P. Z. S. 1837, 9.—*Craxirex galapagoensis*, Gould, Zoöl. Beagle, pt. 3, 1841, 23, pl. 2. Gray, Gen. 2; ed. 2, 3; List Gen. and Subg. Brit. Mus. 2. Bonap. Consp. 1850, 34.—*Buteo galapagoensis*, Gray, List B. Brit. Mus. 1844, 18; Gen. fol. 1849, 12, sp. 12; Hand List, I. 1869, 7.—Strickl. Orn. Syn. I. 31.—Sund. P. Z. S. 1871, 125, 127. Scl. & Salv. Nom. Neotrop. 1873, 119. Sharpe, Cat. Ac. B. M. 1874, 170. *Dromolestes galapagoensis*, Sund. Disp. Acc. Hemeroharp. 1874, 27.—*Buteo leucops*, Gray, Cat. Acc. 1848, 36; Weigm. Arch. XVI.\1850. Bonap. Consp. 1850, 17.—*Pœcilopternis infulatus*, Kaup. Contr. Orn. 1850, 76.

Habitat.—Galapagos Islands, only.

Description.—" Adult male (type of species): Everywhere sooty black, with a brownish shade, especially distinct on the wing-coverts; quills black, the secondaries browner, and tipped with buffy white, the primaries externally shaded with ashy, all barred with blackish-brown, more distinctly below, where the interspaces are dull ashy-white; tail grayish-brown, tipped with fulvous, and crossed with thirteen blackish bars, the subterminal one slightly the broadest; under surface of the body sooty black, with a clearer shade of brown, more distinct on the under wing-coverts, which are also tinged with rufous. Total length 20.50 inches, culmen, 1.7; wing, 15.15; tail, 9.2; tarsus, 2.85." (Sharpe, l. c.)

Young (specimens in the Museum of the Academy of Natural Sciences of Philadelphia): (1) Tail brownish-gray, fading narrowly into whitish at the tip, and crossed by about eleven narrow, rather distinct, bands of black. Prevailing color blackish-brown, the head, neck, and lower parts variegated with pale ochraceous, chiefly in the form of a basal spotting, most exposed on the head, neck, and breast. Tail coverts barred transversely with ochraceous-white. Wing, 16.80; tail, 10.70; culmen, 1.25; tarsus, 2.65; middle toe, 2.10. Fourth quill longest; first shorter than seventh. (2) Tail brownish-gray, with a hoary cast, faintly whitish at the tip, and crossed by more than eleven narrow and very indistinct bands of dusky; inner webs reddish-white. Prevailing color above brownish-black, with a purplish cast; head, neck, and lower parts ochraceous-white. Dorsal region and wing-coverts much variegated longitudinally with deep ochraceous; head and neck streaked with black; lower parts spotted with dark purplish-brown; tibiæ with sparse, longitudinally-sagittate, markings of the same. Tail-coverts (upper and lower) very distinctly barred transversely.

2. **Buteo (Craxirex) poliosomus.**

Falco polyosoma, Quoy. & Gaim. Voy. Uran. Ois. 1824, 92, pl. 14.—*Astur polyosoma*, Cuv. Reg. An. I. 1829, 332.—*Buteo poliosoma*, Less. Traité, 1831, 82. Strickl. Orn. Syn. I. 1855, 219. Scl. P. Z. S. 1860, 384. Abbott, Ibis. 1861, 151. Scl. & Salv. Nom. Neotrop. 1873, 119. —*Buteo poliosoma*, Sharpe, Cat. Acc. B. M. 1874, 171.—? *Buteo ventralis*, Gould, P. Z. S. 1837, 10. Darwin, Zoöl. Beag. pl. 3, 27. Gray, Gen. (sub. *borealis*) sp. 6. Bonap. Consp. 19. Strickl. Orn. Syn. I. 31. Cass. Expl. Exp. Orn. 1858, 94, pl. 3, fig. 2 (♀ jus. ?) *Buteo varius*, Gould, P. Z. S. 1837, 10 Darw., Zool. Beag. 1841, 26. Cass. Expl. Exp. Orn. 1858, 92, pl. 3, f. 1 (♂ jus.). Peale, Expl. Exp. Orn. 61. ?Scl. P. Z. S. 1860, 384.

Habitat.—Chili, Patagonia, Tierra del Fuego, and Falkland Islands.

Description.—Adult. "Bluish slate-color above and below, a little clearer about the head and throat; lores whitish; upper and under tail-coverts white, with slaty-gray cross bars and mottlings of the same color; tail white crossed with about nine narrow bands of slaty-gray, and a very broad subterminal band of slaty-black; primaries black, externally shaded with silvery-gray, the secondaries entirely slaty-gray like the back, tipped with white; primaries white at base of inner web, with remains of dusky slate-colored bars. Total length 22 inches; culmen, 1.4; wing, 15.25; tail, 8.5; tarsus, 3.4." (Sharpe, l. c.)

"Female (? in changing plumage): All over blackish slate-color, excepting the hinder neck, the entire mantle and upper scapulars, the centre of the breast, extending on to the chest and centre of the abdomen, all these rufous portions of the body more or less obscured with slate-color; quills black, silvery-gray near the base, barred with black; inner face of quills ashy-white, with a few dusky crossbars; lower back, rump, and upper tail-coverts ashy, the former slightly washed with rufous; tail ashy-white, with about nine narrow bars and a broad subterminal band of slate-color, less distinct below. Total length 22.5 inches, culmen 1.75, wing 15, tail 9, tarsus 3.50." (Sharpe, l. c.)

Young (from specimens in the United States National Museum): Tail brownish-gray, with more or less of a hoary cast, usually passing into grayish-white at the tip, and crossed by very numerous (more than fifteen) narrow, rather indistinct, somewhat oblique, bars of dusky—becoming gradually obsolete basally, and very oblique on the inner webs. Upper parts blackish-brown, variegated with deep ochraceous, especially on the wing-coverts, scapulars, and upper tail-coverts; head streaked with the same; secondaries and primaries obscurely banded with dusky and fading into paler at tips. Lower parts ochraceous, the jugulum, breast, and sides longitudinally striped with blackish; sides tinged with rusty; tibiæ and crissum transversely spotted, or barred, with rufous; a more thickly spotted belt across the abdomen and flanks. Inner webs of primaries pure white anterior to their emargination, and immaculate, or very faintly barred. Wing, 15.50–18.10; tail, 9.30–10.50; culmen, 1.00; tarsus, 3.25–3.55; middle toe, 1.50–1.90.

Remarks.—We are inclined to regard the plumage described by Mr. Sharpe as the female in changing plumage, as being in reality the adult female in full dress. A specimen in the U. S. National Museum corresponds quite closely except that it is still more rufous, and has the tail as in the young plumage (described above) with the exception of a single feather of the new moult. This specimen (No. 68,369, Nat. Mus., Chile?), which is unmistakably in transition plumage, may be described as follows: Tail dull gray, with a perceptible hoary wash, crossed by an indistinct subterminal band (about .50 wide), and by very numerous (more than fifteen) narrow bars of darker; these bars most distinct on the inner webs, which are white to a greater or less distance from their inner edge; shafts pure white, except terminally; remiges dull slaty, with a hoary cast, paler (not white) at tips, and crossed by numerous, distinct, narrow bands of blackish; wing-coverts more dusky, and more or less variegated with rusty. General color of the plumage rusty chestnut, much broken by lighter (ochraceous) and darker (brownish-black) spotting and barring—the former color mostly marginal or terminal, the latter central on the feathers; the chestnut is deepest and most uniform on the back, lesser wing-coverts, and abdomen; the ochraceous prevails across the breast, while on the scapulars the black transverse bars predominate; on the head the predominant color is black, the feathers being merely edged laterally with rufous; on the cheeks the black is nearly uniform. Lining of the wing rich chestnut—the rufous broken by darker and lighter spotting; inner webs of primaries ash-gray, with indistinct, very narrow, deeper-gray, oblique bars.[1]

The tail-feather (middle one) of the new moult, completely grown, is colored as follows: The prevailing color is silvery-gray, but this changes gradually to white along the shaft, but toward the end this gives way to a subterminal band of deep black, about one inch wide, and distant half an inch from the end; the remainder, or gray portion of the feather, is crossed by about twelve narrow, zigzag bars of deeper gray, these becoming gradually more indistinct basally, where they are broken into a confused mottling.

A young male, supposed to be from Chile (No. 1624, Museum of the Wesleyan University, Middletown, Connecticut) is colored as follows: Tail dull brownish-gray to the tip, crossed by numerous (more than fifteen) narrow bars of dusky; remiges dull brownish-slate, distinctly banded with bars of dusky black; rest of upper parts nearly uniform blackish-brown, slightly variegated (more heavily on upper tail-coverts) with ochraceous. Head blackish-brown, faintly edged with ochraceous, with a large, plain, ochraceous area on the auricular region. Lower parts (except throat) ochraceous-white, with sharply-defined, broad, longitudinal stripes of blackish-brown; tibiæ with irregular hastate spots of rufous; crissum with sparser, finer markings of the same. Lining of the wing ochraceous-white, with large but not crowded spots of brownish-black; inner webs of primaries white, marbled along the edge with slate.

Material examined.—U. S. National Museum, Washington, 4.

3. Buteo (Craxirex) erythronotus.

Haliaëtus erythronotus, King, Zoöl. J. III., 1827, 424; Voy. Beag. I., 532. —*Buteo erythronotus*, Darwin, Zool. Beag. 1841, 26. Gray, Gen. fol. sp. 9; List B. Brit. Mus. 35. Hand List, I., 1869, 8. Bridg., P. Z. S. pt. 11, 109; Ann. N. H. XIII., 499. Jard., Edin. Phil. J., n. s. II., 117. Strickl. Orn. Syn. I. 1855, 34. Scl. P. Z. S. 1860, 384; Ibis, 1860, 25, pl. 1, f. 3. Abbot, Ibis, 1861, 151. Scl. and Salv., Nom.

[1] This is the character of the quills of the new moult; several old ones, which were not cast, are pure white instead of ash, the bars of the same shade as in the new feathers.

Neot. 1873, 119. Sharpe, Cat. Acc. B. M. 1874, 172.—*Tachytriorchis erythronotus*, Bonap., consp. 17.—*Pœcilopternis erythronotus*, Kaup, Contr. Orn. 1850, 76. Bonap. Consp. I., 1850, 17.—*Aquila braccata*, Meyen, Beitr, 1834, 65.—*Buteo bracchatus*, Pelz. Verh. z.-b. Wien, 1862, 12.—*Buteo tricolor*, D'Orb. et Lafr. Syn. Av. 1838, 6. D'Orb. Voy. Am. Merid. 1840, 69, 106, pl. 30.—*Buteo unicolor*, D'Orb. et Lafr. l. c. p. 7.—*Hypomorphnus leucurus*, Lafr. R. Z. 1849, 338.—*Buteo polyosoma*, Schl. Mus. P.-B. Buteones 1862, 12; Rev. Acc. 1873, 109 (not of Quoy and Gaim !).

Habitat.—Pacific slope of South America, from Peru to Falkland Islands; Chile; Patagonia, on both coasts, up to 40°.

Diagnosis. — Dimensions. Wing, 14.25–16.30; tail, 7.30–9.00; culmen, .83–1.00; tarsus, 2.95–3.50; middle toe, 1.30–1.50. Form: Third or fourth quill longest; first intermediate between eighth and ninth. Tail even in the adult, slightly rounded in the young. Color: Adult, tail pure white (the lateral feathers scarcely tinged with ash), crossed near the end by a subterminal band of uniform black about 1.00 wide; the white portion crossed by fine lines or narrow bars of plumbeous. Above, including the rump, and sides of the neck, mostly or wholly uniform plumbeous; throat, cheeks, and rest of lower parts pure white, the sides (always), frequently the abdomen and usually the tibiæ more or less barred with plumbeous. ♂. Upper parts entirely uniform plumbeous, without any rufous. ♀. Back and scapulars uniform bright rufous. Young. Tail hoary ash, uniform, or growing gradually paler basally, with a narrow dusky subterminal band, and narrowly barred to the base with dusky, these bars sometimes nearly obsolete or broken into an irregular mottling. Above blackish-brown, much variegated, especially on the wing-coverts, scapulars and upper tail-coverts, with ochraceous or rufous. Lower parts ochraceous or ochraceous-white, the middle of the breast usually inmaculate, but the sides of the breast, the sides and the abdomen marked with broad transverse bars of rusty or longitudinally cuneate spots of brownish-black; the breast sometimes with narrow streaks of the same; tibiæ and crissum with narrower rusty bars, or hastate spots.

Remarks.—In the adult there is sometimes an entire absence of bars on the white portion of the tail. One adult female has a few rufous feathers on the sides of the breast.

A young male is marked as follows:—

Tail hoary ash, narrowly barred to the base with darker, and with a narrow subterminal dusky band. Upper parts blackish-brown, much variegated, especially on the wing-coverts, scapulars, and upper tail-coverts, with reddish-ochraceous or rufous. Lower parts deep ochraceous, the sides of the breast, sides, and abdomen, with large, longitudinal, cuneate spots of brownish-black; middle of the breast with narrow lines of the same; tibiæ and crissum with large hastate spots of rusty. Young ♀. Tail whitish-ash, becoming paler basally, mottled with darker and with a badly defined subterminal band of dusky. Entire back and scapulars plain bright rufous, and the wing-coverts, rump, upper tail-coverts, and head and neck, much tinged with the same.

A young female in Mr. Lawrence's collection differs only in the coloration of the lower parts, the ground-color of which is ochraceous-white; the pectoral area is immaculate; the abdomen, sides, flanks, tibiæ, and crissum are barred with rusty—the bars narrower on the tibiæ, and more distant on the crissum; there is a distinct rictal "moustache" of black.

Material examined.—U. S. National Museum, 7; Mus. Academy of Natural Sciences of Philadelphia, 4; Mus. Comparative Zoology, Cambridge, 2; Mus. Boston Society of Natural History, 3; Mus. G. N. Lawrence, Esq., 1. Total number of specimens examined, 16.

Measurements.

Sex.	Wing.	Tail.	Culmen.	Tarsus.	Middle toe.	Specimens.
♂	14.25—14.75	8.00—8.30	.80—.85	3.10—3.20	1.30—1.50	8.
♀	14.70—16.30	7.30—8.90	.80—1.00	2.95—3.50	1.40—1.50	5.

4. **Buteo (Craxirex) albicaudatus.**

Aquila coliblanca Azara, Apunt. I. 1802, 69.—*Buteo albicaudatus*, Vieill., N. D. IV. 1816, 477. Pucher. Rev. et Mag. 1850, 87. Strickl. Orn. Syn. I., 1855, 35.—*Tachytriorchis albicaudatus*, Sharpe, Cat. Acc. B. M. 1874, 162.—*Spizaëtus leucurus*, Vieill., N. D. XXXII. 1819, 59.—*Buteo leucurus*, Lafr., R. Z. 1849, 100.—*Falco pterocles*, Temm., Pl. Col. I., 1823, pls. 56 (adult), and 139 (young).—*Buteo pterocles*, Less., Man. I., 1828, 103. Gray, Gen. I., 1849, 12; Hand List, I., 1869, 8. Caban. Schom. Reise in B. Gui. III., 1848, 739. Burm. Th. Bras. II. 1855, 49. Sehl. Mus. P.-B., Buteones, 1863, 13; Rev. Acc. 1873, 110. Pelz. Orn. Bras., 1871, 3, 396. Scl. and Salv. Nom. Neot., 1873, 119.—*Tachytriorchs pterocles*, Kaup, Class. Säüg. Vög., 1844, 123; Contr. Orn. 1850, 75. Bon. Consp. I., 1850, 17.—*Buteo albicauda*, Less, Traité, 1831, 81, pl. 15. Pucheran, R. et M. Zool. 1850, 214.—*Buteo tricolor*, Hartl., Ind. Azara, 1841, 1 (not of D'Orb.).

Habitat.—The whole of Middle America, north to Mirador (on the eastern side), Colima (west coast) and the City of Mexico (central plateau); eastern South America as far as Paraguay.

Diagnosis.—Wing, 14.50–18.00; tail, 7.70–10.50; culmen, .95–1.05; tarsus, 3.30–3.70; middle toe, 1.55–1.80. Form: Third quill longest; first intermediate between sixth and eighth. Tail even in adult, slightly rounded in young. Color: Adult, tail white (the lateral feathers much tinged with ash), crossed by a broad subterminal band of black; the white portion crossed by faint lines or narrow bars of plumbeous. Above dark plumbeous; rump and lower parts pure white; throat plumbeous-black, or bluish-plumbeous. Flanks, rump, and lining of the wing usually faintly barred with ashy, dusky, or rufous. ♂: Lesser wing-coverts with a restricted patch of rufous on the anterior portion; longer scapulars strongly tinged with rufous. ♀: Rufous patch on lesser wing-covert region extended over nearly the whole of its area; longer scapulars scarcely tinged with rufous. Young: Tail hoary grayish (the inner webs mostly white), growing gradually darker terminally, and passing narrowly into dull whitish or rufous at tip; crossed with numerous narrow and very obscure bars of darker, these growing gradually obsolete towards the base.[1] General color brownish-black, the lower parts more or less variegated (most conspicuously on the posterior portions, and on middle of the breast) with ochraceous or whitish.

Remarks.—The identity of specimens of the two plumages described in the diagnosis as "adult" and "young" is proven by specimens in which part of the tail feathers are of one plumage and part of the other. Such a specimen is in Mr. Lawrence's collection from the city of Mexico.

The older individuals in the immature dress are colored as follows: Tail hoary ash, growing darker terminally, and passing narrowly into brownish-white at the tip—the inner webs mostly white; the terminal half with just descernible obscure bars of darker, these becoming gradually obsolete on the basal half; sometimes they are entirely obsolete for the full length of the outer webs. Upper tail-coverts pure white, usually immaculate,

[1] These bars are sometimes entirely obsolete on the outer webs.

but sometimes barred ; inner webs of primaries ashy, the two or three outer ones more whitish, and sometimes barred with dusky. In males, the middle of the breast, the tibiæ and crissum, are usually ochraceous irregularly spotted with brownish-black.

The darker-colored individuals in this stage are distinguishable from the dark examples of the young of *C. swainsoni* only by the very much stouter and longer tarsi.

The adults vary but little. The white of the jugulum usually reaches forward medially into the plumbeous of the throat, and in one (♂ ad. Tehuantepec, Mexico ; Sumichrast) it extends—interruptedly, however—to the chin. Another male from the same locality has the scapulars almost entirely rufous, with black shaft-streaks. The white of the lower parts in the adult is of a pureness and continuity strikingly characteristic of this species.

A very young specimen from Paraguay has the tail more brownish, more distinctly barred, and more ochraceous on the tip ; the upper tail-coverts are ochraceous marked with broad crescentic bars of blackish, and the upper parts generally are variegated with ochraceous.

Material examined.—U. S. National Museum, 12 ; Museum of the Academy of Natural Sciences of Philadelphia, 6 ; Museum of G. N. Lawrence, Esq., 1 ; other specimens,[1] 4. Total number of specimens examined, 23.

Measurements.

Sex and age.	Wing.	Tail.	Culmen.	Tarsus.	Middle toe.	Specimens.
♂ ad.	16.30—16.70	7.50—9.00	.95—1.10	3.30—3.55	1.60—1.80	5
♂ juv.	14.50—16.75	8.60—8.75	1.02—....	3.30—3.60	1.55—1.65	3
♀ ad.	17.75—.....	8.25—....	1.00—....	3.60—....	1.75—....	1
♀ juv.	17.00—17.75	8.40—10.30	.95—1.05	3.30—3.70	1.60—1.80	3

5. **Buteo (Craxirex) Swainsoni.**

? ? ? *Buteo cinereus*, Vieill., Ois. Am. Sept. 1807.—"*Buteo vulgaris*," Swains. & Rich., F. B. A. II., 1831, 41, pl. 27 (adult). Jard. (ed. Wils.), Am. Orn., II., 1838, 56. Brewer (ed. Wils.), Am. Orn., 303. Synop., 1852, 684.—*Buteo swainsoni*, Bonap., Comp. List., 1838, 3 ;

[1] These are specimens collected on the Isthmus of Tehuantepec, by Professor F. Sumichrast, and not entered in the Register of the National Museum.

Consp., 1850, 19; Pr. Ac. Nat. Sc. Phil., 1855, 280. Heerm., Pac. R. R. Rep., II., 1855, 32. Cassin, Pr. A. N. S. Phil., 1855, 280; B. Cal., Tex., etc., 1855, 98; B. N. Am., 1858, 19, pl. XIII. Strickl., Orn. Syn., I., 1855, 30. Gamb., Jour. Ac. N. Sci. Phil., 18—, I., 27. Blakist., Ibis, 1861, 317 (eggs). Pelz. Verh. z.-b. Wien, 1862, 150. Dresser, Ibis, 1865, 324 (Texas). Coues, Prod., 1866, 9; Key, 1872, 217; Am. Nat., 1874 (habits). Gray, Hand List, I., 1869, 7. Coop., B. Cal., 1870, 476. Ridgw., Pr. Ac. Nat. Sci. Phila., 1870, 142; B. B. & R., Hist. N. Am. B., III., 1874, 263; Pr. Boston Soc. N. H., May, 1873, 27. Scl. & Salv., Nom. Neotr., 1873, 119.—*Buteo montanus*, Nutt., Man. I., 1840, 112.—*Buteo bairdii*, Hoy, Pr. Ac. Nat. Sci. Philad., 1853, 451 (young). Cassin, B. Cal., Tex., etc., 1854, pl. XLI.; B. N. Am., 1858, 21. Strickl., Orn. Syn., I., 1855, 37. Gray, Hand List, I., 1869, 8.—*Buteo insignatus*, Cass., B. Cal., Tex., etc., 1854, 102, pl. XXXI. (melanistic phase); B. N. Am., 1858, 23. Heerm., Pac. R. R. Rep., VII., 1857, 31. Strickl., Orn. Syn., I., 1855, 38. Scl., P. Z. S., 1856, 285. Coues, Pr. Ac. Nat. Sci. Philad., 1866, 45. Bryant, Pr. Boston Soc. N. H., X., 1865, 90. Scl., Ibis, I., 216 (Guatemala). Gray, Hand List, I., 1869, 8. Cooper, Orn. Cal., I., 1870, 474.—*Buteola insignata*, Bonap., Comp. Rend., XLII., 1856, 956.—*Buteo oxypterus*, Cass., Pr. Ac. Nat. Sc., VII., 1855, 282 (young); B. N. Am., 1858, 30, pl. 15, fig. 2. Strickl., Orn. Syn., I., 1855, 28. Coues, Pr. Ac. Nat. Sci. Philad., 1866, 45; Key, 1872, 218. Gray, Hand List, I., 1869, 8. Cooper, Orn. Cal., I., 1870, 480.—*Buteo swainsoni* var. *oxypterus*, Ridgw., B. B. & R. Hist. N. Am. B., III., 1874, 266.—*Buteo fuliginosus*, Scl., Pr. Zool. Soc., Lond., 1858, 356; Trans. Zool. Soc., 1858, 267, pl. LXII. (♂ ad., melanistic phase). Cass., B. N. Am., 1858, pl. 15, fig. 1. Salv., Ibis, 1860, 401. Gray, Hand List, I., 1869, 7. Ridgw., Pr. Ac. Nat. Sci. Philad., Dec. 1870, 142.—*Buteo gutturalis*, Max., Caban. Journ., VI., 1858, 17 (eggs).—"*Buteo harlani*, Aud." Bryant, Pr. Boston Soc. N. H. VIII., 1862, 115.—"*Buteo albonotatus*, Kaup," Lawr. Ann. N. Y. Lyc. IX., April, 1868, 133 (nec Kaup).—"*Buteo albicaudatus*, Vieill.," Scl., P. Z. S., 1869, 634, No. 22 (Buenos Ayres).—*Buteo obsoletus*, Sharpe, Cat. Acc. Brit. Med., 1874, 184 (nec *Falco obsoletus*, Gm., 1788 !).

Habitat.—Found chiefly in the Western Province of North America, where it is a very abundant species, but an occasional visitant to portions of the Eastern Province (chiefly north of the Great Lakes and the St. Lawrence River), and straggling into South America, as far as Patagonia. All portions of the Western Province of North America, from Mazatlan, Mexico, to the Yukon in Alaska, and from the Pacific coast eastward to the eastern base of the Rocky Mountains (National Museum); interior of British America north to the fifty-seventh parallel (Swainson & Richardson); Canada and Wisconsin (Museum Philadelphia Academy); Massachusetts (Museum Wm. Brewster); Illinois (Ridgway); Arkansas, Mazatlan, Costa Rica, and Argentine Republic (National Museum); Guatemala (Sclater); Patagonia (Sharpe); Masafuera (Salvin, *in epist.*).

Diagnosis.—Dimensions: Length, 19.00–22.00; extent, 48.00–56; wing, 12.00–17.25; tail, 8.00–9.80; Culmen, .80–.95; tarsus, 2.30–2.90; middle toe, 1.40–1.70.[1] Weight, $1\frac{1}{2}$–$3\frac{1}{2}$ lbs. Form:

[1] These figures are based upon the following measurements made by the author:—

I. Measurements of prepared specimens. Museums.

Sex and age.	Wing.	Tail.	Culmen.	Tarsus.	Middle toe.	Examples.
♂ ad.	14.40—16.00	8.00—9.00	.80—.90	2.30—2.75	1.40—1.60	17
♀ ad.	14.75—17.25	9.00—9.80	.80—.95	2.50—2.90	1.50—1 65	20
♂ juv.	14.80—15.10	8.50—9.00	.80—.90	2.60—2.80	1.45—1.65	5
♀ juv.	15.30—16 20	8.70—9.60	.80—.90	2.65—2.75	1.50—1 70	5

II. Measurements of fresh specimens in the field (in connection with the duties of the Zoologist of the United States Geological Exploration of the Fortieth Parallel, Clarence King, Esq., United States Geologist, in charge). These measurements require explanation in order that they may be understood. They come in the same sequence in each instance, as follows: (1) Total length, from the point of the bill to the end of the tail; (2), widest expanse of the wings, from tip to tip; (3), length of the wing from the carpal joint to the point of the longest primary; (4), length of the wing from the metacarpo-phalangeal joint; (5), length of the culmen along the chord of the arch; (6), length of the tarsus in front; (7), length of the middle toe to the base of the claw; (8), length of the tail from the base of the coccyx; (9), length of the tail from the end of the upper coverts.

a. Summaries of field notes.—♂, ad. (Four specimens, Nevada and Utah, coll. U. S. Geol. Expl. 40 Par.): $19\frac{1}{2}$–20; 48–$50\frac{1}{4}$; $12\frac{7}{8}$; $\frac{15}{16}$; $1\frac{5}{8}$; $7\frac{3}{4}$; $4\frac{1}{2}$; weight $1\frac{1}{2}$–$2\frac{1}{4}$ lbs. Upper mand. deep black, scarcely bluish basally; lower black with basal $\frac{1}{3}$ light blue; cere and rictus greenish gamboge, or dull light lemon-yellow; eyebrow olivaceous; iris deep hazel, or burnt-sienna—sometimes yellowish on upper portion; tarsi and toes deep light chrome-yellow; claws black.

♀, ad. (Eight specimens, Nevada and Utah, coll. U. S. Geol. Expl. 40 Par.): 21–22; $50\frac{1}{2}$–56; $16\frac{1}{2}$–17; $13\frac{1}{2}$–14; 1; 2; $8\frac{5}{8}$; 5; weight $2\frac{1}{4}$–$3\frac{1}{2}$ lbs. Bill slate-black, becoming light slate-blue basally; cere and rictus light gamboge, sometimes tinged with greenish; eyebrow olivaceous-yellow; iris deep hazel; tarsi and toes deep chrome-yellow; claws black.

Only three outer primaries with inner webs emarginated: third or fourth (usually the third) quill longest; first shorter than the

♂, juv. (Two specimens, W. Nevada, coll. U. S. Geol. Expl. 40 Par.): $18\frac{1}{4}$–$19\frac{3}{8}$; $43\frac{3}{4}$–$45\frac{1}{2}$; $12\frac{1}{4}$–$13\frac{3}{4}$; $9\frac{3}{4}$–$10\frac{3}{4}$; $\frac{27}{32}$; $1\frac{1}{2}$; $6\frac{3}{4}$–7; $3\frac{3}{4}$–$4\frac{1}{8}$. Bill dull black, becoming pale blue towards rictus, and on basal half of lower mandible; cere and rictus yellowish-green: iris cinereous, with brownish outer wash; tarsi and toes pale ashy-green; claws dull slate-black. Weight $1\frac{3}{8}$–$1\frac{1}{2}$ lbs.

♀, juv. (Three specimens, W. Nevada and Utah, coll. U. S. Geol. Expl. 40 Par.): $16\frac{1}{2}$–21; 45–$50\frac{3}{4}$; 13–14; $10\frac{1}{8}$–11; $\frac{15}{16}$–1; $1\frac{5}{8}$–$1\frac{3}{4}$; $6\frac{7}{8}$–$7\frac{1}{2}$; 3–$3\frac{3}{4}$; weight 2 lbs. Iris as above, or yellowish-brown; feet as above (youngest specimens) or light chrome-yellow (older).

b. Notes on individuals.—109, ♀, juv. Big Bend of the Truckee (Camp 12), Nevada, July 26, 1867. $16\frac{1}{2}$—45—13—$10\frac{1}{8}$—1—$1\frac{5}{8}$—$6\frac{7}{8}$—3. Bill dull black, inclining to pale blue on the rictus and on the basal half of the lower mandible; cere pale yellowish-green; iris cinereous, with a brownish outer wash; tarsi and toes very pale ashy-green.

113, ♀, ad. (Fuliginous plumage, parent of Nos. 109, 115, 116, and 117). Camp 12, July 29, 1867. $21\frac{1}{2}$—53—17—14—1—2—$8\frac{5}{8}$—5. Weight $2\frac{1}{4}$ pounds. Bill slate-black, light blue basally; cere and rictus pure light yellow; iris deep hazel; tarsi and toes light chrome-yellow; claws black.

114, ♂, ad. (Normal plumage, mate of the preceding). Camp 12, July 29, 1867. $19\frac{3}{4}$—48—16—$12\frac{7}{8}$—$\frac{15}{16}$—$1\frac{5}{8}$—$7\frac{3}{4}$—$4\frac{1}{2}$. Weight $1\frac{1}{2}$ pounds. Cere and rictus light, dull lemon-yellow; tarsi and toes deep chrome-yellow; iris deep hazel.

115, ♀, juv. Camp 12, July 29, 1867. $19\frac{3}{4}$—47—14—11—$\frac{15}{16}$—$1\frac{3}{4}$—$7\frac{1}{2}$—$3\frac{3}{4}$. Weight 2 pounds. Same remarks as to No. 109.

116, ♂, juv. Camp 12, July 29, 1867. $19\frac{3}{8}$—$45\frac{1}{2}$—$13\frac{3}{4}$—$10\frac{3}{4}$—$\frac{27}{32}$—$1\frac{1}{2}$—7—$3\frac{3}{4}$. Weight $1\frac{3}{8}$ pounds. Same remarks.

177, ♂, juv. Camp 12, July 29, 1867. $18\frac{1}{4}$—$43\frac{3}{4}$—$12\frac{1}{4}$—$9\frac{3}{4}$—$\frac{27}{32}$—$1\frac{1}{2}$—$6\frac{3}{4}$—$4\frac{1}{8}$. Weight $1\frac{1}{2}$ pound. Same remarks.

771, ♀, ad. (Intermediate plumage, barred ochraceous belly). Truckee Reservation, May 29, 1868. (Shot from nest.) $21\frac{1}{2}$—52—$16\frac{1}{2}$—$13\frac{1}{2}$. Weight 3 pounds. Bill deep black, the upper mandible scarcely paler basally; lower, with the basal third pale blue; cere and rictus greenish-gamboge; iris burnt sienna; tarsi and toes deep gamboge, with a greenish tinge.

1072, ♀, ad. (Normal plumage, immaculate white belly). Salt Lake City, Utah, May 31, 1869. 21—53. Weight $2\frac{1}{2}$ pounds. Bill slate-black, becoming light slate-blue basally; cere and rictus greenish-gamboge; naked eyebrow olive-yellow; iris deep fine hazel; tarsi and toes deep chrome-yellow. (Stomach filled with grasshoppers.)

1073, ♀, ad. (Normal plumage, immaculate white belly). Same locality and date. $21\frac{1}{2}$—53. Weight $2\frac{1}{2}$ pounds. Same remarks.

1074, ♀, ad. (Normal plumage, immaculate white belly). Same locality and date. 22—$53\frac{1}{2}$. Weight $2\frac{3}{4}$ pounds. Same remarks.

sixth (usually about equal to—rarely shorter than—the seventh). Wing reaching nearly to the end of the tail; primaries exceeding secondaries by about one-third the length of the wing. Tail even. Transverse scutellæ on front of the tarsus, 9–13. Color: Tail grayish-brown, or grayish, sometimes with a hoary-cast, usually passing narrowly into whitish at the tip, and crossed by an indefinite number of very indistinct narrow bands of a darker shade. Colors of other portions extremely variable. Adult, nearly uniform dusky brown above, the frontlet, concealed bases of occipital feathers, and the upper tail-coverts more or less mixed with white; beneath sometimes pure white, with a broad patch of uniform brown or rufous on the breast, and white throat-patch, but from this light extreme the lower parts vary to uniform dusky chocolate or sooty brown, through intermediate shades of ochraceous or rufous upon which ground deeper-colored bars are visible on portions posterior to the pectoral patch; very rarely the lower parts are irregularly spotted with brown, while the pectoral patch is broken up into similar spotting by the admixture of more or less of white. In the extreme melanistic condition the bird is uniformly blackish-brown, with white bars on the crissum. Young, ochraceous and purplish-black, in relative quantities varying according to the individual; the ochraceous forms the ground

1075, ♀, ad. (Normal plumage, immaculate white belly). Same locality and date. 21½—54. Weight 2¾ pounds. Same remarks.

1291, ♂, ad. (Normal plumage). Parley's Park, Utah, June 25, 1869. 20—50. Weight 2¼ pounds. Upper mandible, deep black, scarcely bluish basally; lower, with basal third light blue; cere and rictus greenish-gamboge; iris burnt-sienna, yellowish on top; eyebrow olivaceous; tarsi and toes deep, light chrome-yellow.

1310, ♂, ad. (Normal plumage). Parley's Park, June 26, 1869. 19½—48. Same remarks.

1335, ♀, ad. (Fuliginous plumage). Parley's Park, June 28, 1869. 22—56—17. Weight 3½ pounds. Bill black, pale blue basally; cere and rictus greenish lemon-yellow; iris deep brown; tarsi and toes chrome-yellow.

1359, ♂, ad. (Normal plumage, very white below). Parley's Park, July 2, 1869. 20—50¼. Same remarks.

1360, ♀ ad. (Fuliginous plumage, very black; mate of the preceding!) Parley's Park, July 2, 1869. 21—50½. Weight 2½ pounds. Same remarks.

1501, ♀, juv. Parley's Park, August 10, 1869. 21—50¾. Bill black, becoming pale blue basally; cere and rictus, fine yellowish-green; iris yellowish-brown; tarsi and toes light chrome-yellow.

color, and usually predominates, but is sometimes much less in amount than the black; the tail is the same as in the adult.

a. Normal phase.

Adult: Above continuous blackish-brown, the feathers usually with somewhat paler borders; outer scapulars and upper tail-coverts very rarely tinged with rufous—the latter usually more or less barred with white or ashy; occipital feathers white beneath the surface; primaries plain brownish-black, without trace of bars on outer webs. Throat and chin more or less white, usually in form of a sharply-defined patch; jugulum and breast brown, generally plain, very rarely spotted with whitish, the tint varying from rufous (♂) to the color of the upper parts (♀). Other lower parts varying from white to ochraceous (rarely almost rufous), generally more or less barred, or spotted transversely, with dark brown or rufous—very rarely immaculate; crissum usually immaculate, but sometimes with faint and distant bars. Lining of the wing white, sometimes tinged with ochraceous; often immaculate, but generally sparsely (never heavily) spotted with rufous or brown. Under surface of the primaries cinereous (the outer two or three more whitish) sometimes plain, sometimes indistinctly barred with darker.

♂. Breast-patch rufous with darker shaft-streaks.

♀. Breast-patch dark grayish-umber, or blackish-brown (like the back).

Young: Above brownish-black, with a faint purplish lustre, the feathers all paler on their borders; wing-coverts and scapulars more or less variegated with ochraceous or whitish spotting, this usually very conspicuous on the longer scapulars; upper tail-coverts ochraceous or whitish (their inner webs more brownish), barred with dusky. Tail as in the adult. Ground color of the head, neck, and lower parts, ochraceous, varying in shade from very deep cream-color to nearly white; the feathers of the head, neck, anterior part of the back, and sides of the breast with medial longitudinal tear-shaped spots of brownish-black; lower parts generally spotted, sometimes everywhere, with black, and occasionally immaculate.

b. Melanistic phase.

Adult: Prevailing color plain blackish-brown; the tibiæ, lining of the wings, and sometimes the breast, inclining, more or less, to rufous. Crissum usually white, sometimes immaculate, generally barred with rusty or blackish; occasionally with dusky and whitish bars of equal width. No white on the throat, or else but little of it. Young: Brownish black, variegated with ochraceous spotting, in amount varying with the individual.

Remarks.—The above diagnosis is based upon upwards of one hundred specimens, and may be considered as covering every phase, seasonal, sexual, and individual, assumed by the species. So great is the extent of individual variation, that, taking a series of specimens of either plumage, scarcely two can be found which are alike in all their markings, especially those on the lower surface of the body.

The plumage of the upper surface, however, is so constant, that, taking ever so large a series of adults, and turning them on their bellies so that the backs of all are presented to view at once, a specimen in the least degree aberrant is very rare, while one very noticeably different can scarcely be found; and when such a one is detected, it is generally found that the difference is a seasonal, rather than an individual, one. Thus, in specimens which have just completed the new moult, some of the longer scapulars are seen to be slightly variegated with ochraceous on their edges; while in those in which the feathers have become old, these paler mottlings and edges are "worn" off, causing a very uniform shade of dark grayish-brown to prevail continuously over the upper parts, though each individual feather fades gradually in depth of color on its borders. As a rule, the brown of the upper parts is a shade lighter and more grayish in the males than in the females, and there is apt to be a slight rufous edging to the feathers of the neck, as well as a tinge of the same on the upper tail-coverts; while not unfrequently the longer scapulars have their exterior edges tinged with rufous. But these differences between the sexes are so exceedingly slight as to be appreciated only upon actual comparison of specimens, and even then do not prove sufficiently constant to be considered of any importance.

Reversing the position of the specimens, so as to present their lower surfaces to view, they can be immediately placed into two groups, distinguished by the color of the patch on the breast. One lot has this patch clear, rather light, cinnamon-rufous; the other has it dark grayish-brown, the same color as the upper parts. Upon examining the labels, the first series is found to be composed entirely of males, while those of the second are all females.

In a series of nine normally-colored adult males, all but two have the rufous breast-patch abruptly defined posteriorly, against the white of the posterior lower parts, the outline being semicircular and pretty firm. The remainder of the lower surface is white, with little, if any, general ochraceous tinge; the inside of the tibiæ is quite strongly washed with this color. One specimen (No. 161 Mus. R. R., Wahsatch Mountains, Utah, June 27) is almost immaculate beneath, posterior to the clear cinnamon-rufous breast patch, there being only a very few scattered and minute hastate specks of rust on the abdomen. The remaining five are more or less speckled or barred underneath, the amount of these markings varying with the individual—the lightest-colored being almost as continuously white as that just described, the darkest having the abdomen thickly, though rather faintly, barred. Two of the specimens have the bars on the upper portion of the abdomen (just below the rufous pectoral area) darker rusty and connected by longitudinal streaks of blackish running along the shafts of the feather. The tibiæ may be either immaculate or faintly barred; but the crissum is immaculate in all. The two remaining specimens of the series are quite aberrant in the plumage of the lower parts; thus, No. 65,918, Long Coteau River, Dakota (September 9, 1873), has the abdomen, sides, and tibiæ heavily barred with rufous, of a more rusty, or less ochraceous, tint than that of the breast; these bars are rather broader than the intervening whitish ones, are very irregularly defined, and become narrower and fainter on the tibiæ; the crissum has a small and very faint transverse bar near the tip of each feather. The feathers of the sides have blackish shaft-streaks. No. 5,576, North Platte (August 21, 1856), has the rusty-rufous of the breast continued back to the anal-region and tibiæ; the abdomen, sides, and flanks are variegated only by the sharply-defined black shaft-streaks on each feather; the tibiæ and anal-region are transversly broken by paler bar-like "washings;" the crissum is white with distant bars of rusty.

A series of nineteen adult females in the normal plumage presents much greater and more complicated variations than does that of the male birds. Fourteen of them have the lower parts posterior to the breast-patch more or less ochraceous (the ground color varying from buff to rufous), and *everywhere*, except on the crissum, heavily barred with darker rusty and blackish-brown; the prevailing form of these bars varies with the individual; in all but one, their direction is decidedly transverse, but as a rule they are neither sharply defined nor regular; on the tibiæ they are narrower, fainter, and more decidedly rufous; on the upper part of the abdomen they are more or less modified in shape by an increased breadth along the shafts of the feathers, sometimes running together, and then forming a median chain of diamond-shaped spots, which are usually more blackish than the other markings. Some specimens have these diamond-shaped spots, the characteristic *pictura* of the lower parts, in which case the transverse bars are indistinct, if not obsolete, but the strong transverse barring is the rule. In the darker of these specimens there is a gradual transition between the uniform brown of the jugulum to the broken tint of the lower breast; and in these specimens the white of the throat is more or less streaked with dark brown. In nine of the fourteen specimens, however, the dark grayish umber jugular area is abruptly defined, with a firm semicircular outline, against the immediately lighter region posterior to it, while the throat of these specimens is plain white, in the form of a well-defined patch. The remaining five specimens differ decidedly from the series above described. Four of them agree in having the lower parts posterior to the breast-patch almost free from markings. The color of these parts is alike in all, and is a creamy white (less pure than in the very light-colored males), with the tibiæ, especially their inner sides, more strongly ochraceous. One of them is so nearly immaculate, that a dozen or so minute hastate specks of brown scattered over the upper portion of the abdomen constitute all the variegation of the lower surface. The most heavily spotted one has large transverse spots along the sides, and more irregular, even some longitudinal, ones along the middle portion of the lower breast. This example differs from the others in having the brown of the jugular patch broken up by a conspicuous spotting of ochraceous-white, this most distinct along the median line. No. 1,271 (Mrs. C. E. Aiken), El Paso, Colorado, May 6, is almost exactly similar. The remaining specimen is a very remarkable one in every way, and is entirely aberrant and exceptional in its peculiar features. *The relative position of the areas where light and dark markings respectively prevail is exactly reversed*, the pectoral region being white, with a longitudinal tear-shaped spot of blackish-brown on the tip of each feather, while the abdomen, sides, and flanks are so heavily marked with more or less confluent transverse spots and bars of dark brown, that this forms the predominant color of those parts; the tibiæ are finely and regularly barred with dark brown. The style of coloration of the lower parts of this specimen strikingly calls to mind that of the adult, normally colored *Archibuteo lagopus* (var. *sancti-johannis*). The gular region is white, with a conspicuous medial stripe of dark brown, while it is bordered on either side by a broader one of the same color. The ear-coverts are so much streaked with white that this color prevails; while the neck is very heavily spotted with the same at the bases of the feathers. The measurements are as follows: wing, 16.70; tail, 9.00; culmen, .95; tarsus, 2.90; middle toe, 1.65. This specimen was obtained May 29, 1868, on the Wahsatch Mountains, Utah, by Mr. L. E. Ricksecker. The sex is queried as male upon the original label. Altogether, it is so far out of the usual range of variation which obtains in the species, that it may possibly eventually prove to belong to another species.

The melanistic plumage grades from individuals only a little darker beneath (with less-defined bars) than the clearly-barred ones described above, up to others which are entirely black, except the crissum and tail. The latter is always as in the normal plumage, while the former always has some white—this forming the prevailing color in seven out of eight examples. Of the eight specimens before me, only two have the crissum immaculate white, and have much white on the throat. One of them has the tibiæ and anal-region narrowly barred with light rusty. Three others have the white of the crissum marked with a very few, distant, and faint bars of rusty. Two others are broadly barred with blackish-brown, while the remaining one (No. 12,117, Mazatlan, Western Mexico) has these black bars so much wider than the white ones that the crissum seems black barred with white, rather than the reverse. Two specimens (No. 12,117, Mazatlan, and No. 22,569, Onion River, Arctic America) are absolutely uniform and continuous brownish-black, except the crissum. No. 6,455, Nebraska, has the breast and tibiæ bright rufous, the lining of the wing rusty white. A male from Arizona in Mr. Aiken's collection has the lining of the wing deep rusty rufous with blackish shaft-streaks, the breast and tibiæ blackish-brown.

The plumage of the young varies between great extremes, and were it not for the specific characters at once recognizable in the peculiar proportions, and characteristic details of structure, certain individuals could not be identified at all. There is, however, an average style of which the specimen described on p. 112 (No. 10,761) is a fair representative. Upwards of twenty specimens have been examined, and sixteen are now before me. Of the series now under consideration, twelve have the ground-, and prevailing, color of the head, neck, and lower parts, soft, fine ochraceous-buff, or deep cream-color. Only one is without spots on the lower parts posterior to the jugulum. On two, the black spotting nearly equals in extent of color the ochraceous;[1] the tibiæ are heavily spotted, upon a rusty ochraceous ground. In one of them, the crissum is also distantly barred. The remainder of the series have the crissum immaculate, five of them have the tibiæ more or less barred, while no two are alike in the quantity of spotting on the breast, abdomen, etc., or in the exact shape and distribution of the spots—though the whole series is intermediate in these respects between the two specimens mentioned above as the light and dark extremes of the series, and which were taken from the same nest.

Three others differ from the above series in having the ground-color of the head, neck, and lower parts nearly white, with only a slight tinge of ochraceous, and with the few markings of the lower surface restricted chiefly to the sides of the breast. They are from Buenos Ayres, Costa Rica, and Nebraska; and though from localities so remote from each other, they are almost as nearly duplicates of each other as is ever seen—but of these specimens, I have more to say beyond (see page). The remaining one is a young example of the melanistic plumage; and in it the black markings of the lower parts of course predominate over the light ones. The ground-color may, in fact, be considered as brownish-black, variegated with ochraceous.

The upper parts vary with the individual in the proportionate

[1] One of these specimens was taken from the same nest along with the very light-colored one mentioned. Their parents were a very white-bellied male, and a very uniformly blackish female!

amount of black and ochraceous, though the former is always greatly in the excess. The latter is not unfrequently absent, but a conspicuous spotting and bordering of ochraceous may be taken as the rule, exemplified by probably 80 or 90 per cent. of the specimens.

Two specimens from Wisconsin, in the Museum of the Philadelphia Academy, differ from any in the National collection, though they are as unlike each other as any which I ever compared. One of them (the type of *B. bairdii*, Hoy) is unusually light-colored underneath, and very continuously blackish on the upper surface. The lower parts are light buff or cream-color, with a few triangular spots and shaft-lines of black on the sides of the breast; the lining of the wing is entirely immaculate.

The other specimen (Menonomee Marsh, near Milwaukee, spring of 1851) is just the opposite extreme in plumage, being unusually dark for a young bird. On the upper parts, the continuity of the black is scarcely broken; while beneath, the black spots are so large as to cover nearly the whole surface. The pileum, and nape and broad "mustache" stripe from the rictus down to the jugulum, with nearly the whole pectoral region, unbroken black, leaving only the gular region and sides of the head pale, but even these places are thickly streaked. The measurements are as follows: Wing, 15.00; tail, 8.80; tarsus, 2.35; middle toe, 1.50.

A specimen from Iowa (No. 59,052, L. E. Ricksecker) is like the average western style. A young female from Arizona (September 23, Captain Charles Bendire, U. S. A.) in Mr. Aiken's collection differs from the type of "*B. bairdii*" only in deeper shades of colors—as nearly as my memory of the latter justifies comparison. The Massachusetts specimen in the possession of Mr. Brewster I have seen; it is very dark, closely resembling, according to my recollection of it, the black example from Wisconsin described above.

The following detailed descriptions are taken from the best representatives of each stage of plumage in the collection:—

Normal phase.

Adult=*B. swainsoni*, Bonaparte. Male (53,105, Truckee River, Nevada, July; C. King, R. Ridgway): Head, neck, and upper parts blackish-brown; scapulars slightly variegated with a rufous mottling; upper tail-coverts white tinged with rufous, and with transverse bars of blackish-brown, about six on each feather. Tail dark brown like the back, approaching back terminally, basally with a slight hoary cast; crossed by about ten narrow, very obscure bands of nearly black. Front and whole throat clear white, immaculate, and sharply defined against the surrounding blackish; lores dusky. Whole breast, cinnamon-rufous (forming a wide, sharply defined patch), marked laterally with the brown of the neck; each feather with a shaft-line of black; rest of lower parts, including whole lining of the wing, continuous ochraceous-white, the latter region unvariegated; sides with sparse, faint, transverse bars of rufous, and shaft-lines of darker. Under side of primaries light slate anterior to emargination, beyond which they are black; slaty portion crossed by very obscure bars of darker. Fourth quill longest, third scarcely shorter; second equal to fifth; first intermediate between seventh and eighth. Length, 19.75; extent, 48.00; wing, 15.40; tail, 8.00; tarsus, 2.32; middle toe, 1.60. Weight $1\frac{1}{2}$ lbs. Bill slate-black, bluish basally; cere, and angle of mouth, light dull lemon-yellow; iris deep hazel; tarsi and toes deep chrome yellow; claws black.

Female (58,507, Great Salt Lake City, Utah, May; C. King, R. Ridgway): Similar to the male, but pectoral area blackish-brown, like the back; blackish-brown of upper surface untinged with rufous, all the feathers, however, fading on edges; bands of the tail scarcely distinguishable on outer webs; white of forehead very restricted; lining of the wing marked with small cordate or deltoid spots of black; under surface of primaries plain deep slate. Abdomen and sides variegated with a few irregular longitudinal spots, and on the latter, transverse bars of dark brown; tibiæ with faint bars of rufous. Fourth quill longest; third scarcely shorter; second very slightly shorter than fifth; first intermediate between seventh and eighth. Length, 21.50; extent, 54.00; wing, 16.50; tail, 8.50; tarsus, 2.70; middle toe, 1.70. Weight, $2\frac{3}{4}$ lbs.

Young = *B. bairdii*, Hoy, and *B. oxypterus*, Cassin (10,761, Rocky Mountains, September; C. Drexler): Head, neck, and entire lower parts fine delicate ochraceous, or cream-color; feathers of the crown, occiput, and neck, each with a medial stripe of black, of less amount, however, than the ochraceous; forehead, superciliary region, and ear-coverts, with only a few very fine hair-like shaft-streaks; on the chin, and across the cheeks, are longitudinal spaces of blended streaks of black, the latter forming a conspicnous "mustache;" sides of the breast with large ovate spots of black; middle of the breast with less numerous, smaller, and more longitudinal ones of the same; sides, flanks, and abdomen, with broad hastate spots, more irregular and transverse on the former; throat, tibiæ, anal-region, and lower tail-coverts immaculate. Upper surface generally, deep black, the feathers bordered with pale ochraceous, the scapulars and middle wing-coverts much variegated with the same; secondary-coverts, secondaries, and primaries narrowly tipped with white. Upper tail-coverts pale ochraceous, barred with black. Tail ashy-brown, very much lighter than the rump (more hoary than in the adult), narrowly, but clearly, tipped with white, and crossed by ten or twelve narrow bands of black, more distinct than in the adult. Under surface of primaries more whitish than in the adult.

Male (No. 8550, Fort Fillmore, New Mexico; Dr. T. C. Henry, U. S. A.):[1] Head, neck, and lower parts, soiled ochraceous-white. Feathers of the head above, and neck laterally and behind, with medial stripes of blackish-brown; jugulum, breast, sides, flanks, and abdomen, with large rounded spots of blackish-brown; tibiæ with transverse bars of the same; lower tail-coverts almost immaculate. A conspicuous "mustache" of blended dusky streaks, from angle of the mouth across the cheeks, the dusky suffusing the lores. Whole auricular region scarcely variegated pale yellowish; entire chin and throat immaculate. Prevailing tint above, blackish-brown, becoming purplish-black on primaries; outer surface of wing plain, but interscapular region somewhat variegated with partially concealed, irregular blotches of deeper ochraceous than the lower parts; upper tail-coverts with pairs of indistinct white spots. Tail grayish-brown (white at extreme base), crossed with about ten narrow, indistinct, but regular bands of dusky. Lining of the wings yellowish-white, with sparse cordate spots of blackish, this tint prevailing over the under primary coverts; under surface of the primaries pure purplish-black after their emargination, but anteriorly plain hoary brown, growing paler basally. On inner webs are very indistinct transverse spots of dusky, touching neither the edge nor shaft of the feather, and entirely concealed when the wing is closed. Shafts of primaries pure white on under side; on outer side, dark brown. Wing

[1] Type of *B. oxypterus*, Cassin!

formula, 3–4–2–5–6–7–1, 8. Three outer primaries emarginated on inner webs; second, third, and fourth, sinuated on outer. Wing, 13.70; tail, 7.00; tarsus, 2.10; middle toe, 1.35. Primaries project beyond secondaries, 5.50.

Female (33,508, San José, Costa Rica; J. Carmiol):[1] Differs from the type chiefly in lighter colors. The whole forehead very broadly immaculate dull white, this continuing back to the occiput in a broad unstreaked superciliary stripe; along the upper edge of the ear-coverts is a rusty suffusion, with condensed, fine dusky streaks, forming an indistinct stripe separating the wholly white ear-coverts from the supraoral stripe; the "mustache" is very conspicuous; the breast has a few large tear-shaped spots of clear blackish-brown, and the sides have very sparse, irregular, and more sagittate spots of the same; the whole posterior parts are immaculate. The upper parts are more variegated with paler, the wing-coverts and rump having the feathers irregularly bordered with whitish. The upper tail-coverts are white, barred with dark brown. Tail, hoary brown, crossed by nine or ten nearly obsolete, narrow bands of dusky. Whole lining of the wings immaculate, except the conspicuous patch on the primary coverts. The whole under surface of the primaries is uniform slaty, gradually deepening into black towards ends. Wing-formula, 3–4–2–5–6–7, 1. Wing, 15.00; tail, 8.00; tarsus, 2.45; middle toe, 1.55. Primaries project beyond secondaries, 6.00.

The specimen from Buenos Ayres (No. 55,876, ♂ *juv.*, Conchitas, November, 1868; Wm. H. Hudson) was labelled by Mr. Sclater "*B. albicaudatus*," and so published (Proc. Zool. Soc., Lond., 1869, 634). This species, however, though belonging strictly to the same section of the genus with *B. swainsoni*, and being in fact its nearest ally, is yet very distinct, having altogether larger and longer tarsi. The National Museum contains a fine suite of this species, illustrating the variations to which it is subject. This specimen is exactly like the Costa Rican one just described.

[1] Type of description in Baird, Brewer, and Ridgway's Hist. N. Am. Birds (vol. III. p. 267) of *B. swainsoni* var. *oxypterus*. "*B. albonotatus*" Lawr., Ann. IV. 7. Lyc. N. H., IX. Ap'l, 1868, 133!

Melanistic Phase.

Adult, = *B. insignatus*, Cassin, and *B. fuliginosus*, Sclater. Male (No. 12,117, Mazatlan, Mexico; Colonel Abert): Entirely fuliginous-black, darkest on head and back; no white on forehead. Tail cinereous-umber, crossed with seven very regular and continuous bands of black, the subterminal one of which is broadest. Lower tail-coverts, and larger under wing-coverts, with transverse bands of dull white; lining of the wing unvaried black; under surface of primaries silvery-white, that portion beyond their emargination black, the whitish portion crossed by distant, very indistinct transverse bars. Third quill longest; fourth and fifth scarcely shorter, and nearly equal; second equal to sixth; first shorter than eighth. Tail even; scutellæ of the tarsus very faintly defined, or, in fact, scarcely detectable (probably accidental). Wing, 13.00; tail, 7.00; tarsus, 1.95; middle toe, 1.55.

Male (22,567, Onion River; R. McFarlane): Entirely brownish-black, whole under surface of wings included; lower tail-coverts equally barred with white and black. Tail blackish-slate, narrowly paler at the tip, and crossed with numerous oblique bars of dusky black; upper tail-coverts barred obsoletely with lighter slaty-brown. Wing, 15.00; tail, 8.00; tarsus, 2.20; middle toe, 1.50. Fourth quill longest; third, next; second, shorter than fifth; first, slightly shorter than eighth.

Female (12,927, Utah Valley, July; C. S. McCarthy): Similar; lower tail-coverts white, tinged with rusty, and barred with brown; tibiæ tinged with chestnut. Wing, 16.50; tail, 8.80; tarsus, 2.60; middle toe, 1.65. Third and fourth quills equal and longest; third shorter than fifth; first equal to eighth.

The melanistic specimen from Mazatlan (No. 12,117) described above agrees perfectly with Mr. Sclater's excellent figure of his *B. fuliginosus* above cited, and the only discrepancy in the description is in the measurements, those given for the *B. fuliginosus* being, wing, 12.00, tail, 6.50, and tarsus, 2.60. The difference in the length of the wing is certainly not great, while the discrepancy as regards the length of the tarsus it is probable results from a different mode of measurement.

Material examined.—National Musuem, 88 specimens; Museum of the Academy of Natural Sciences of Philadelphia, 3; of the Boston Society Natural History, 1; of the Museum of Comparative Zoology, Cambridge, Mass., 1; of George N. Lawrence, Esq., 2; of William Brewster, Esq., 1; of Charles E. Aiken, Esq., 3; of R. Ridgway, 5. Total number of specimens examined, 104.

Buteo (Craxirex) pennsylvanicus (Wils.).

Falco pennsylvanicus, Wils. Am. Orn. VI. 92, pl. liv. f. 1, 1812 (nec. V. pl. 46, fig. 1!). Lath. Gen. Hist. I. 263, 1821. Aud. B. Am. pl. xci. 1831; Orn. Biog. I. 461, 1831. Bonap. Ann. Lyc. N. Y. II. 29, 434; Isis, p. 1137, 1832. Nutt. Man. I. 105, 1833. Temm. Pl. Col. 67, 1836.—*Buteo pennsylvanicus*, Bonap. Oss. Cuv. Rég. An. p. 35, 1830; Eur. & N. Am. B. p. 3, 1838; Consp. Av. p. 19, 1850. Aud. Syn. p. 7, 1839. Brew. (Wils.). Am. Orn. Syn. p. 648, 1852. Gray, Gen. sp. 8, 1844; List B. Brit. Mus. p. 16, 1844; Hand List, I. 1869, 7. Cass. B. Cal. & Tex. Syn. p. 100, 1854. Strickl. Orn. Syn. I. 32, 1855. De Kay, Zool. N. Y. II. 11, pl. v. fig. 11, 1844. Cass. Birds N. Am. 29, 1858. Dresser, Ibis, 1865, 325 (Texas), Scl. P. Z. S. 1858, 451 (Ecuador, winter); P. Z. S. 1857, 211 (Orizaba); Ib. 261 (Upper Amazon). Caban, Journ. II. lxxxii. (Cuba). Gundl. Rept. 1865, 223 (Cuba, resident). Lawr. Am. N. Y. Lyc. VII. 1861, 288 (Panama); Ib. IX. 133 (Costa Rica). Schl. Mus. P. B. Buteones, 1862, 20; Rev. Acc. 1873, 109. Allen, Bull. Mus. Comp. Zool. II. 1871, 330. Gundl. J. f. O. 1871, 266. Pelz. Orn. Bras. 1871, 396. Coues, Key, 1872, 217. Scl. &. Salv. Nom. Neot. 1873, 119.—*Astur pennsylvanicus*, Cuv. Reg. An. (ed. 2), I. 332, 1829. James. (Wils.) Orn. I. 65. Sund. Disp. Acc. Hemeroharp. 1874, 24.—*Falco latissimus*, Wils. Am. Orn. (last ed.), VI. 1812, 92, pl. liv. f. 1.—*Astur latissimus*, Jard. (ed. Wils.) Am. Orn. II. 1832, 294.—*Buteo latissimus*, Sharpe, Cat. Acc. B. M. 1874, 193.—*Falco wilsoni*, Bonap. Obs. Wils. Nomencl. J. Ac. Nat. Sci. Phil. III. 348.—*Pœcilopternis wilsonii*, Kaup, Isis, 1847, 330; Cont. Orn. 1850, 75.—*Buteo wilsoni*, Bonap. Consp. I. 1858, 19,—*Sparvius platypterus*, Viell. Enc. Méth. III. 1823, p. 1273 (quot. Wils. pl. liv. fig. 1).

Hab.—Eastern Region of North America, eastern Middle America, south to Ecaudor (Sclater), Upper Amazon (Sclater), and Caraccas (New York Mus.). Cuba (resident).

Diagnosis.—Adult: Upper surface dark umber-brown, the feathers gradually paler toward edges; on the back, the feathers more uniformly dusky, causing a prevalent blackish appearance. Rump and upper tail-coverts blackish vandyke-brown, the latter tipped with pure white, and with a concealed bar of the same, about the middle of each feather. Tail dull black, with an indistinct terminal band of dull brown, this fading terminally into whitish; across the middle of the tail a broad band of dull light umber (in some individuals approaching dull white) about three-fourths of an inch in width; about as far anterior to the main band as this is from the tip is another much narrower and less distinct band of the same color, crossing just beyond the ends of the coverts, or concealed by them. Primaries uniform brownish-black, fading on the terminal edge into pale brown. Head above, and broad but inconspicuous "mustache," running from the rictus downward across the cheek, dull black; the crown posteriorly, with the occiput and nape, having the dull black much broken, caused by the lateral streaks of dull rufous on all the feathers; this dull rufous tint prevails on the rest of the head and neck, as well as the breast, leaving the lores and chin and lateral portion of the frontlet alone whitish; throat streaked with blackish. Beneath dull brownish-rufous, that of the breast almost unvariegated; medially, however, are roundish spots of white on opposite webs, but these are not confluent; posteriorly, these spots become gradually more numerous and more transverse, forming on the flanks transverse bands, almost continuous; on the tibiæ the white prevails, the rufous bars being more distant, and connected only by a brown shaft-line; lower tail-coverts with less numerous, transverse spots of dull rufous. Lining of the wing ochraceous-white, with sparse, rather small, irregularly deltoid spots of dull rufous; under surface of the primaries unvariegated white, as far as their emargination, beyond which they are black. Fourth quill longest; third a little shorter; second intermediate between fifth and sixth; first about equal to the ninth. Female (extremes 30,969, Brookline, Mass., and 30,895, Mirador, Mexico—the latter the larger): Wing, 11.00–11.30; tail, 6.80–7.10; tarsus, 2.30; middle toe, 1.30. Male (32,309, Moose Factory, Hudson's Bay Territory): Wing, 10.50; tail, 6.30; tarsus, 2.30; middle toe, 1.20.

Young male, second year? (39,106, Remedios, Cuba, June; N. H. Bishop): Upper parts similar to adult, but a reddish tint appreciably washing the edges of the interscapulars and (less noticeably so) the scapulars. Bands on tail nearly as in adult, but very near the base is a fourth, very narrow and faintly defined, pale band, while the bases of all the feathers are much mottled with white. Dull rufous of the breast not continuous, but in the form of large longitudinal broad spots, occupying the greater middle portion of each feather; abdomen, sides, and tibiæ with smaller and more cordate spots of dull rufous; the lower tail-coverts immaculate; the decided ochraceous tinge beneath, deepest posteriorly.

Young, first year (11,984, Washington, D. C.): The blackish above is much variegated, being broken by narrow rusty borders to the interscapulars, rump-feathers, and lesser wing-coverts, the broader and more ochraceous borders to scapulars and greater wing-coverts, and partially concealed whitish spotting on the former. Upper tail-coverts white, with broad bars of blackish-brown; secondaries and primaries edged terminally with whitish. Tail dull umber-brown, growing darker terminally; narrowly tipped with white, and crossed with six obscure, narrow bands of dusky, the (concealed) bases of all the feathers white. Superciliary region, cheeks, chin, throat, and entire lower parts, delicate pale ochraceous, or whitish cream-color; a conspicuous "mustache," a medial longitudinal series of streaks on the throat, with large longitudinal ovate spots on sides of breast, cordate spots on sides and flanks, and sagittate spots on tibiæ, clear blackish-brown. The ochraceous deepest on the abdomen and crissum. Wing beneath as in adult.

A very young bird, scarcely fledged (33,598, Milltown, Me.; G. A. Boardman), differs from the last in a much more continuous black shade above, the deeper ochraceous beneath, and larger, as well as more numerous, blackish spots beneath.

Remarks.—In the adult plumage of this species, the principal variation is in the continuity or distinctness of the anterior light band on the tail, and the extent and depth of shade of the brown beneath. The first feature is characteristic of most specimens, only one (55,980, ♂, Costa Rica) being without it; it is broadest and most conspicuous, as well as less concealed by the coverts, in the females, and this appears to be the principal sexual difference. The dull brownish-rufous of the under parts is most prevalent in a specimen from Mirador, Mexico (30,895, ♀? September; Dr. Sartorius), in which specimen the breast is almost continuously of this color, and the lower tail-coverts are strongly barred (or transversely spotted) with the same; the ground-color beneath is also more ochraceous than in any other individual. In the Costa-Rican specimen (the one lacking the anterior tail-band), the brown beneath is quite different from that of the others, being of a much more ashy shade; the lower tail-coverts are also immaculate. The brown markings beneath are most sparse in 20,389, from Coban, Vera Paz (January; O. Salvin); in this, also, the tail-bands are very distinct, and almost white.

A young bird from Costa Rica (30,412; Dr. Frantzius) is exactly similar to No. 27,048, from Fort Garry, Selkirk Settlement.

Material examined.—U. S. National Museum, 32; Museum of the Academy of Natural Sciences of Philadelphia, 6; of Boston Society, 3; American Museum, New York, 2; Museum Comparative Zoology, Cambridge, 2; G. N. Lawrence, Esq., 5; R. Ridgway, 2. Total number of specimens examined, 52.

Measurements.

	Wing.	Tail.	Culmen.	Tarsus.	Middle toe.	Specimens.
♂	9.85—10.70	6.50—7.00	.70—...	2.15—2.80	1.20—1.38	11
♀	11.00—11.40	7.00—8.00	.70—.78	2.20—2.70	1.30—1.40	14

April 6.

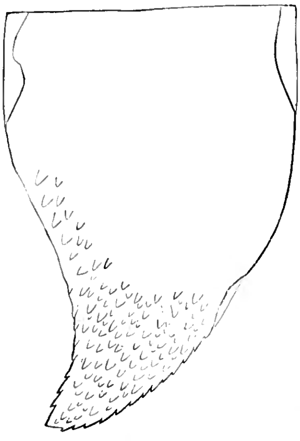
The President, Dr. Ruschenberger, in the chair.

Twenty-six members present.

Remarks on a Coal Fossil, etc.—Prof. Leidy said that among the objects presented this evening there are several worthy the attention of the members.

One of these is a specimen of the Ceratodus Forsteri, from Queensland, presented by Dr. John Belisario, of Sidney, Australia, through Dr. McQuillen. The fish is a representative of the Dipnoi, or double breathers, like the Lepidosiren, being provided with both lungs and gills. The genus was long ago named by Agassiz, from isolated teeth found in the Triassic and Jurassic rocks of Europe. The C. Forsteri was discovered only a few years since, and was referred to Ceratodus by Dr. Günther, from the near resemblance of the teeth of the fish to the fossils described under that name.

Another specimen, presented by Dr. S. C. De Vesy, of Williamstown, Dauphin Co., Pa., appears to be a fitting companion to the former. It consists of a fragment of coal shale, from the coal mines of Williamstown, with an impression which looks as if it might be that of the tail of a relative of the Ceratodus, or of a huge tadpole. Among the many enigmatic impressions occurring in the coal shales, this is better defined than usual. It is $8\frac{3}{4}$ inches long and 6 inches at the widest part. The accompanying figure is an outline sketch one-fourth the diameter of the original. Towards the upturned end of the specimen there are many strongly impressed conical pits, looking as if produced by prominent scale-like appendages, in the interspaces of which there are many minute impressions of the same form. The character of the fossil is very uncertain; it may be that of a batrachian or fish allied to Ceratodes. The coal period is well characterized by abundance of remains of both kinds of animals. Perhaps, however, the impression may be of vegetable origin.



¼ diameter.

Accompanying the fossil, there is another fragment of coal shale with vegetable remains, and apparently a lamellibranch shell.

Remarks on Elephant Remains.—Prof. LEIDY called attention to the fragment of a fossil elephant molar tooth presented this evening by Messrs. W. W. Jefferis, and J. B. Dillingham.

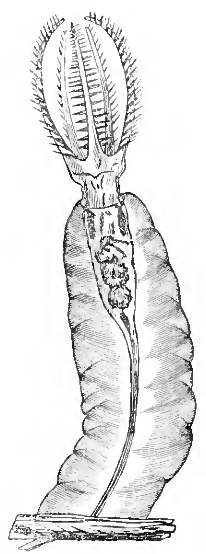
The specimen consisted of four dental plates, and is quite friable. Adherent to it are a number of crystals of vivianite and also some of the same material in pulverulent form. It was found resting on the Kaolin bed, about eight feet from the surface of the American Kaolin Works, near Chadd's Ford, Delaware Co., Pa.

Prof. Leidy also exhibited drawings of an elephant tooth which had been submitted to his inspection by Dr. E. A. Wood, of Pittsburg. The specimen was dredged at the confluence of the Monongahela and Alleghany rivers. The tooth, an upper molar, is well preserved and nearly entire. Weight 9 lbs. $15\frac{1}{2}$ ounces. The triturating surface extends about half the fore and aft measurement of the tooth, and exhibits a dozen double dentinal bars.

Another drawing, submitted by Prof. E. O. Hovey, represents a hugh elephant tooth, from California, and now preserved in the cabinet of Wabash College, Indiana. The specimen appears to be a last molar, and weighs $21\frac{1}{2}$ lbs. Towards its backpart the tooth is 13 inches long. The triturating surface, $7\frac{1}{2}$ inches long, presents eleven double dentinal plates.

All the specimens are supposed to belong to the extinct American Elephant, Elephas americanus.

Remarks on Stephanoceros. — C. NEWLIN PEIRCE exhibited drawings of a specimen of an aquatic animal, belonging to the genus Stephanoceros, which had been recently observed by him. In doing so, he said he was induced to bring it before the Academy because it was, he believed, rarely met with in this country, and had not been previously here described.



In its main characteristics, such as spiral carapace or case, five tentacle-like lobes armed with cilia, or, more properly, setæ, eye-spots, jaws, stomach, etc., it corresponds with the description given by Mr. C. Cubitt in his paper entitled "Observations on the Economy of Stephanoceros," in the "Monthly Microscopical Journal," vol. iii., 1870, p. 242; but in addition to that very full sketch of this interesting object, there were some points of interest not there recorded. First was the great length of setæ or bristles projecting from the ends of the tentacles (only to be seen by especial care in focalizing with the lens), these overlapping each other formed a network in which were entrapped Paramecia of various sizes, as many as forty having been observed there at one time. And by virtue of these long setæ the animal's facility for procuring prey was greatly enhanced.

These minute objects which served as food were by a spasmodic effort of the bristles gradually brought within the arms, and from there, with this continued spasmodic movement which has been described by Mr. Cubitt, were brought within the vortex induced by an arrangement of cilia around the mouth, which, unlike the setæ on the tentacles, were, while the animal was feeding, kept in a whorl.

The action of the setæ on the lobes of the Stephanoceros is spasmodic; it creates no vortex, and it is only by actual contact with these setæ that floating particles are whipped within the area inclosed by the lobes, where, by the same whipping action, they are twitched from point to point, irregularly downwards, until they come within the range of a vortex, which is due not to any action of the setæ, but to a range of minute *cilia* in the funnel, distinct from the foraging appliances.

For two weeks the animal under observation fed voraciously. The last few days of this time granular layers were rapidly deposited on each side of the body just within the case, until the upper part of the carapace was distended with this accumulation. For twenty-four hours following this condition but little or no food passed into the digestive cavity; any infusoria or other foreign substance accidentally coming within the tentacles being immediately expelled by a sudden constriction of these organs at their base.

It was evident from appearances that some change was about to take place. The animal, at first very sensitive, withdrawing into its cell on the slightest jar of the table on which the instrument was placed, now but seldom contracted its retractile muscle even though the zoophyte-trough, in which it was examined, was quite violently tapped.

On the sixteenth day of observation it was unavoidably left for a few hours; on returning to it the tentacles, with the above-described accumulated dark mass, were found to have left the original case and were attached to a portion of the plant beneath the branch to which it (the original case) adhered. It now presented somewhat the appearance of an animal figured and described by Pritchard as a young Stephanoceros, a dark globular mass with five spreading or divergent tentacles, and at the distal extremity a very slight prolongation by which it was attached to a plant-stem by an almost invisible thread, devoid entirely of any cell or carapace. Not long, however, was it destined to remain in this nude condition, for in twenty-four hours appearances of a cell were visible, and within three days it was domiciled in as beautiful a spiral case as the one it had left. Its contractile muscle developing rapidly with the length of the cell, in a few days it presented to the observer all the peculiarities of the parent, and within two weeks was again ready for another change such as is above described, and which was accomplished with a similar result. The Stephanoceros being too high in the scale of animal life to propagate by gemmation or division, the process above portrayed can have but a remote influence upon reproduction, as there was no multiplication by this change.

The original cell with its retracted body within, though remaining for weeks in an apparently perfect condition, was not seen to increase or in the least to change—the growth-force seemingly being confined to the detached head and its accompanying organs.

Dr. Leidy stated that he had never seen specimens of Stephanoceros until they were shown to him by Mr. Peirce.

On the Disposition of the Great Omentum in Cynocephalus porcarius, etc.—Dr. H. C. CHAPMAN made the following remarks:

Man is usually regarded as being the only animal in which the peritoneum exhibits that arrangement in which the great omentum adheres to the colon. I take the opportunity of calling the attention of the members to the fact that I found the great omentum more or less adherent to the colon in a *Cynocephalus porcarius* which recently died at the Zoological Garden as also in a *Mecacus nemestrinus* from the same institution. In the embryonic condition of man the great omentum does not adhere to the colon, and this condition usually remains permanent in the other mammals. In the cases just mentioned we have an interesting illustration of a transitional stage in the development of the peritoneum in man, permanently retained in monkeys.

On the Trias of York County, Pa.—Prof. FRAZER remarked that, as a matter of interest to students of the geology of the Trias, it may be stated that in the recent examination of these beds in York County the supposed constant N. W. dip was found to have very many exceptions.

A further fact was noted, viz., the deposition of these beds at their margin unconformably on the upturned edges of the lower silurian limestone.

Several indentations and bays of this limestone found on the Triassic border, exhibit its last dip away from the latter, which has the opposite dip. The improbability of the formation of these Trias rocks by deposition along a sloping shore was mentioned.

Mr. Young stated that observations recently made by him in the vicinity of Norristown confirmed this state of facts.

Prof. Cope wanted to know what had become of the other side of the basin, if the said theory of the formation of Trias were true.

Prof. Frazer replied that the theory was not his theory, and its difficulties must be overcome by its adherents.

The death of Dr. A. A. Henderson, U. S. N., of Dr. D. R. Bannan, U. S. N., members, and John Edward Gray, correspondent, was announced.

April 13.

The President, Dr. Ruschenberger, in the chair.

Ten members present.

The following paper was presented for publication: "Synopsis of the Geomyidæ." By Dr. Elliott Coues, U. S. A.

April 20.

The President, Dr. Ruschenberger, in the chair.

Twenty-four members present.

The following paper was presented for publication: "Descriptions of a new Fossil Ostrea from the Amazon." By T. A. Conrad.

On a Curious Rhizopod.—Prof. Leidy remarked that in some water with aquatic plants, from Absecom Pond, N. J., preserved in an aquarium during the winter, he had detected a remarkable rhizopod, which he thought might best be compared to the reticular pseudopods of a Gromia separated from the body. The creature moved actively and assumed the most varied forms. At one time it appears as a cylinder or a ball of jelly which may spread itself into a disk of extreme thinness, from the edge of which emanate a multitude of delicate pseudopods minutely ramifying, and with the contiguous branches anastomosing, as in the extension of the net of a Gromia. At other times the creature divides up into branches from a trunk in the manner of a tree, but with the contiguous branches anastomosing. At times also the animal assumes the form of a cord, and the jelly accumulating along some portion of it will then move along the apparent cord like a drop of water running down a piece of twine. The branching pseudopods extending into a net, the large angular meshes gradually contract by the widening of the cords, so that the meshes become perfectly circular and appear like vacuoles imbedded in the jelly. A circulation of jelly with granules is observed along all the pseudopodal filaments exactly as in Gromia. No trace of a nucleus or investing membrane in any position could be detected, but the protoplasmic structure contained a multitude of minute vacuoles. Most of the specimens contained no food, and only one of the largest was observed to contain numerous minute Closteria.

The largest specimen, consisting of a net emanating from three divisions, occupied a semicircular space of $\frac{3}{5}$ of a mm. by $\frac{2}{5}$ mm. Another specimen with a central disk $\frac{1}{5}$ mm. by $\frac{1}{8}$ mm. with its net, occupied a circular space $\frac{2}{5}$ mm. in diameter. A small cord-like specimen was $\frac{1}{5}$ mm. long with an expanded end $\frac{1}{62}$ mm. wide; and another irregular cord-like specimen was $\frac{2}{5}$ of a mm. long with the widest portion $\frac{1}{50}$ mm.

Amœba porrecta, of Schultze, from the Adriatic Sea, most resembles the creature described. While it is nearly related with Gromia, Lieberkuehnia, Vampyrella, Nuclearia, etc., it appears sufficiently distinct in its characters to represent another genus, and with the species may be appropriately named BIOMYXA VAGANS.

On Psorosperms in a Mallard Duck.—Prof. LEIDY remarked that Dr. Elliott Coues had recently submitted to his examination some portions of the flesh of a mallard duck preserved in glycerine. The interstices of the muscles of the duck were stated, in the letter which accompanied the specimens, to be everywhere occupied by abundance of parasites. Specimens of these, in the portions of flesh examined, proved to be oval white bodies from one to two lines long, and about one-third of a line thick. Beneath the microscope they were found to contain myriads of fusiform corpuscles, resembling minute naviculæ, and measuring about the $\frac{1}{1500}$th of an inch in length. Similar bodies were first discovered in many fishes by the late Prof. J. Müller, and described by him as parasites under the name of Psorosperms. They have been repeatedly observed since by Retzius, Robin, and others, in the muscles and other parts of fishes, and they are usually regarded as vegetable parasites. I have not previously heard of similar organisms having been detected in birds. Though the mallard is not a fish eater, the bird may have become infected by having swallowed an infected fish.

On a Mouthless Fish.—Dr. GEORGE W. LAWRENCE, of Hot Springs, Arkansas, in the course of correspondence, had mentioned to Prof. LEIDY the occurrence of a mouthless fish in the Ouachita River. At his request Dr. Lawrence had sent him a specimen, which he now exhibited to the members. The fish is the Buffalo sucker, *Catastomus bubalus*, Kirtland, living in the Mississippi and its tributaries. The specimen is fifteen inches long, and appears to be in good condition. The maxillaries, premaxillaries, and the mandible are absent, and the integument is tightly extended between the end of the snout, the suborbitals, and the articular ends of the quadrates. In the centre of this expansion of the skin there is a small oval aperture one-fourth of an inch fore and aft, and one-eighth of an inch in transverse diameter. The hole is sufficient to admit a current of water for the purposes of respiration; but it is difficult to understand how the fish had procured its food. The cyprinoids, generally, are remarkable for their small toothless mouth, but it is, nevertheless, important in its prehensile capacity. The condition of the specimen is, of course, a deformity, but appears to be the result of a want of development of the jaws, and not of accidental violence. Dr. Lawrence observes that a few of such fishes are caught every year in the Ouachita, sometimes with the oral orifice so small as barely to admit a crow-quill, and occasionally without even the vestige of an orifice. If the last condition really occurs, the fish can only supply itself with food and with water for respiration through the branchial fissures, by the alternating outward and inward movements of the opercula.

On Ouramœba.—Prof. Leidy remarked that his description of the curious rhizopod, he had named Ouramœba, in the Proceedings of May 12, 1874, having been noticed by Mr. Archer, of Dublin, this gentleman had directed his attention to notices of the same animal described in the Proceedings of the Dublin Microscopical Club for Feb. 1866 and Oct. 1873. In these notices Mr. Archer regards the animal only as an *Amœba villosa* in another condition from that ordinarily observed. Mr. Archer's description clearly refers to the same animal as that named Ouramœba, in which he aptly compares the bunch of tail-like appendages to "a bundle of *dipt-candles*," and it is of some interest to know that the singular creature, like so many other rhizopods, is common to Europe and America.

While Mr. Archer regards the "Amœba with remarkable posterior linear processes" (Proc. Dublin Micr. Club, Oct. 1873, 314) as exhibiting another condition of existence of an Amœba from the one usually observed in the genus, he gives no evidence that such is the fact. Until this is proved to be the case the peculiar character of the animal justifies its separation as representing a distinct genus with the name of Ouramœba.

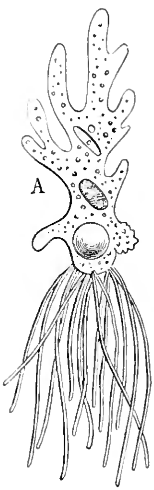
Since the latter was first noticed, many additional specimens have been observed, and though, as in the case of rhizopods generally, they exhibit considerable variation, it appears that several species may be distinguished.

The genus may be thus characterized:—

Ouramœba.—Body, as in Amœba, consisting of an everchanging fluctuating mass of jelly, composed of a granular entosarc, including a contractile vesicle and a discoid nucleus, and defined by a clearer ectosarc. Pseudopods usually digitiform, projecting anywhere but usually in a direction differentiated as forward, and composed of extensions of the ectosarc closely accompanied by included extensions of the entosarc. Posterior part of the body furnished with one or more tufts of non-retractile, rigid, linear appendages, branching radically from common points in the vicinity of the contractile vesicle.

OURAMŒBA VORAX.—Fig. A. Body active, usually ramifying forward from a median stock extending from the posterior blunt extremity. Posterior appendages numerous, originating in several tufts up to five or six, from one-third to nearly the length of the body, linear, straight or curved, uniformly cylindrical, or here and there contracted, commencing in a pointed manner from a common root, and terminating obtusely. Length of body, from $\frac{1}{5}$ to $\frac{1}{3}$ of a mm.; length of appendages from one-third to nearly that of the body.

A



The creature consumes multitudes of diatomes, desmids, and filamentous algæ. Found in springs and ponds, near Darby Creek, Delaware County, Pennsylvania.

Further observations have induced me to believe that the animal named *O. lapsa* is the same as the preceding. A variety has been observed in several instances in which the animal had a single pair of appendages springing from a common root.

OURAMŒBA BOTULICAUDA.—Fig. B. This species is predicated on the form alluded to in my previous communication as having a single tuft of three moniliform rays. I have seen it a number of times since, and its characters appear to be sufficiently constant to recognize it as a distinct species. It is much smaller than the preceding. The body measures about the $\frac{1}{16}$ of a millimetre. The appendages are usually in a tuft of three; each appendage consisting of from one to three sausage-like joints. Found with the preceding.

B

The Occurrence of Celestine in Blair County, Pennsylvania.—Mr. CHAS. A. YOUNG stated that Dana gives, as the original locality of celestine, Frankstown, Huntington Co., Pa. The locality is at Bells' Mills, Blair County. The mineral is found at the foot of the western slope of Brush Mountain, on the west branch of the Little Juniata, one mile south of railroad station.

The celestine occurs in beds of irregular thickness, in a hard gray limestone slate. The beds of the mineral are sometimes almost an inch in thickness, thinning out in the space of a few feet to a thickness scarcely more than that of a piece of paper.

The beds of the mineral sometimes split, having for a parting a soft brown shale, which material also directly underlies and overlies the mineral to a depth of somewhat less than an inch.

The celestine is of the fibrous variety, the fibres being perpendicular to planes of bedding. It is rather pale, the greater part of it having a very faint blue tint.

April 27.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-four members present.

The By-Laws of the Academy were amended, as follows:—Art. 2, Chap. 2, in place of "Minors shall not be eligible as members or correspondents," the following words are substituted:—"Persons not under sixteen years of age may be elected members, provided their nominations be first approved by the Council. Members under the legal age of twenty-one are not entitled to vote at any meeting of the Academy, nor to serve on committees."

On the Structure of the York County Valley Limestone, and on Micro-photography of Minerals.—Prof. FRAZER asked the permission of the Academy to put on record two observations made since the last meeting. The first concerned the structure of the York County limestone valley. H. D. Rogers (whose work was so accurate and full of thought that corrections can only be hazarded after careful consideration), in his report of a section down the Susquehanna from Wrightsville to Havre de Grace, speaks of two folded anticlinals which separate the main synclinal basin of amoral limestone from the smaller one, which crosses the river from Lancaster County near Cabin Branch Run.

The dips as observed and recorded by my party last season fully justify this interpretation, and were it not for other facts not known at the time the above section was made, no one could hesitate to accept this explanation.

But on comparing seven sections made across the lower silurian measures from Littlestown to Wrightsville, it was found that in every case but the latter, there seemed to be abundant evidence of a vault along which the southeastern half of the valley had been torn away by an upthrow, and the remaining limestone abutted on the lower side of the older slates. It was found that the supposed double anticlinal wave structure depended on a single dip, which it only needs to suppose were local in character to bring this section into conformity with the rest. The symmetrical character of the valley also was based upon a single dip in this latter case, not at all inconsistent with a view which would harmonize all the sections.

The other point which Prof. Frazer desired to record was in connection with the reproduction of the structure of the trap rocks as exhibited in thin slices. Among the causes which had hindered the application of micro-photography to this purpose was the fact that the constituent minerals which were colored yellow or red became black in the photograph. The experiment of photographing the slides in polarized light and in different positions of the analyzer has met with very fair success.

The photographs of the enlargements of 34 and 136 diameters, respectively, had been exhibited in connection with a paper read before the last meeting of the American Philosophical Society, but at that time the expedient of overcoming the anactinism of parts of the image was merely suggested. Since then six photographs of the same part of the same thin section of the dolerite, best known, have been made. In five of these photographs all the conditions remained the same except the position of the analyzer, which was rotated to five points corresponding to maxima and minima of some of the more prominent objects in the field. A particular crystal of pyroxene being selected, it was pointed out that in three of the photographs this was light colored with a dark axis, and in two dark with a light axis. Thus in a series of photographic prints made in this way the minerals which were dark from the anactinism of their transmitted light were easily distinguished from those that were dark from opacity, as for example magnetite.

As a means of still further modifying the conditions, No. 6 was photographed just like No. 4, except that a selenite plate was introduced over the slide and between the prisms. Prof. Frazer concluded by remarking that he had delayed returning the thin slides of Connecticut traps prepared and kindly loaned to him by Mr. E. S. Dana, of New Haven, for exhibition before the Philosophical Society, until he had repeated the experiments before the Academy. He informally invited those members to remain after the present meeting who desired to see the slides in polarized light. The Connecticut and Pennsylvania traps were then projected on the screen and their effect on polarized light illustrated.

Ellicott Fisher and J. S. Alexander were elected members, and Col. T. M. Bryan, of Vincenttown, N. J., was elected a correspondent.

The committees to which they had been referred recommended the following papers to be published:—

SYNOPSIS OF THE GEOMYIDÆ.[1]

BY DR. ELLIOTT COUES, U. S. A.

FAMILY GEOMYIDÆ.

The presence of enormous external cheek-pouches, unconnected with the mouth, distinguishes this family of rodents from others excepting its nearest allies, *Saccomyidæ;* which latter, sharing the pouches, differ in the comparative length of the fore and hind limbs, the great length of the tail, size of the eyes and ears, and non-fossorial character of the fore feet. There are numerous and more important anatomical characters, especially in the skulls. The family *Geomyidæ*, equivalent to the *Sciuro-spalacoïdes* of Brandt, and to the subfamily *Geomyinæ* of Baird, consists of two genera, *Geomys* and *Thomomys*, readily distinguished as follows:

Geomys. Superior incisors with a deep groove near the middle, with or without a second fine groove along the inner margin. Claws of fore feet enormously developed. External ears obsolete.

Thomomys. Superior incisors without a central groove, but with a fine groove along the inner margin. Fore claws weaker. External ears distinct.

Geomys has become fairly differentiated into a considerable number of species, while of *Thomomys* all the species hitherto described may be reduced to one, with three marked geographical races, the intergradation between which is still complete. All the described species of both genera are accounted for in the following pages, excepting one, recently published by Peters (*Monatsb. Acad. Wissen.* Berlin, 1864, p. 177), which I have not seen.

I. Genus GEOMYS (ex Raf.).

Mus, sp., Shaw et al., l. c. infra.
Cricetus, sp., Desm. et al., l. c. infra.
Geomys, Raf., Am. Month. Mag. ii. 1817, 45.
Diplostoma, Raf., op. loc. cit.; charact. plerumq. inept. Nec Rich.
Saccophorus, Kuhl, Beit. 1820, 65.
Pseudostoma, Say, Long's Exp. R. Mts. 1823, 406.
Ascomys, Licht. Abh. Acad. Berl. für 1822–'3, 1825, 20.

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[1] This paper is an abstract of results reached in a protracted study of the family, based upon the material in the National Museum, Smithsonian Institution, Washington, D. C. The extended memoir will be published elsewhere.

Analysis of Species.

A. Superior incisors bisulcate ; fore claws enormous ; pouches very large.

a. Upper incisors almost exactly bisected by the large groove, with the fine marginal groove distinct ; tail and feet hairy. . . *bursarius.*

b. Upper incisors divided by the main groove into two unequal portions, of which the inner is the larger, and the fine groove faint or obsolete ; tail and feet nearly naked. . . . . *tuza.*

B. Superior incisors unisulcate ; fore claws and pouches smaller.

c. Superior incisors exactly bisected ; fur soft ; tail and feet hairy.

e. Smaller ; yellowish-brown ; below whitish. . . *castanops.*

f. Larger ; dark reddish-brown ; below plumbeous. . *mexicanus.*

d. Superior incisors unequally divided by the groove into a smaller inner, and larger outer moiety ; pelage hirsute ; tail and feet nearly naked. . . . . *hirsutus.*

1. **Geomys bursarius** (Shaw), Rich.

Mus bursarius,[1] Shaw, Linn. Tr. v. 1800, 227, f. 8 ; G. Z. ii. 1801, 100, pl. 138.

Cricetus bursareus, Desm., Mamm. ii. 1822, 312.

Saccophorus bursarius, Kuhl, Beit. 1820, 65.

Pseudostoma bursaria, Say, Long's Exp. R. Mts. i. 1823, 406.—Aud. and Bach., Q. N. A. i. 1849, 332, pl. 44.

Geomys ? bursarius, Rich., F. B. A. i. 1829, 203.

Ascomys bursarius, Eyd. and Gerv., Voy. Favorite, v. 1839, 23.

Geomys (Saccophorus) bursarius, Gieb., Säug. 1855, 529.

Geomys bursarius, Bd., M. N. A. 1857, 372, pl. 22, fig. 1 a–h, pl. 50, fig. 2 a–g, and of most late writers.—Leidy, these Proceedings, 1867, 97 (Loess of Missouri).

? *Mus ludovicianus*, Ord., Guthrie's Geog. 2d Am. ed. ii. 1815, 292.

? *Diplostoma fusca*, Raf., Am. Month. Mag. ii. 1817, 44.

? *Diplostoma alba*, Raf., l. c.

Saccophorus ? albus, Fisch., Syn. 1827, 305.

? *Geomys cinereus*, Raf., op. cit. 45.

Mus saccatus, Mitch., N. Y. Med. Repos. xxi. 1821, 249.

Ascomys canadensis, Licht., Abh. Acad. Wiss. Berl. 1823, 13, fig.

Geomys canadensis, Le C., these Proceedings, 1852, 158.

? *Geomys drummondii*, Rich., Rep. Brit. Assoc. for 1836, v. 1837, 157 (sp. indet. dentibus prim. bisulcatis).

? *Ascomys drummondii*, Wagn. Suppl. Schreber.

Geomys oregonensis, Le C., op. cit. 160 (assigned locality erroneous).

Geomys breviceps, Baird, these Proceedings, 1855, 334 ; M. N. A. 1857, 378, pl. 52, fig. 2 a–g.

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[1] Only the original references, with a few of the principal additional ones, are given here ; the complete bibliography will appear elsewhere.

Canada Rat, Shaw, l. c.—*Canada Pouched Rat*, Rich., l. c.—*Hamster du Canada*, Desm. l. c.—*Canadian Hamster*, Griffith, A. K. v. 1827, 235.—*Pseudostome a bourse*, Less., Man. 1827, 259.—*Diplostome brun*, *D. blanche*, Desm., Less., ll. cc.—*Goffer*, *Taschenmaus*, Schinz, Syn. ii. 1845, 132. *Gauffre*, *French Canadian* (whence German "Goffer" and English "Gopher").—*Pouched Rat*, *Sand Rat*, *Gopher*, *Pocket Gopher*, *Salamander*, American *Vulgo.*

Diag.[1] Superior incisors bisulcate, with a fine sharp groove along the inner margin, and another much larger bisecting the remaining plane surface. Cheek pouches ample, extending to the shoulders; hands (including claws) longer than the feet; tail and feet hairy; pelage soft, sleek, mole-like. Color dull reddish-brown, beneath muddy or hoary gray, the basal portion of the fur everywhere plumbeous; feet and tail for the most part white or colorless. Varies to a uniform plumbago color. Average dimensions, adult 7–8 inches; tail 2–3 inches; fore foot, with longest claw, about 1.50; hind do, 1.25; longest fore claw about 0.75.

Hab. Valley of the Mississippi, in a broad sense, and somewhat beyond to the northward. "Canada." "Oregon."(???)

2. **Geomys tuza** (Ord), Coues.

Hamster of Georgia, Mitch., N. Y. Med. Repos. v. 1802, 89; Bewick's Quad. 1st Am. ed. 1804, 525.

Mus tuza,[2] Ord, Guthrie's Geog., 2d Am. ed. ii. 1815, 292.

Geomys pinetis, Raf., Am. Month. Mag. ii. 1817, 45 (Georgia).—Baird, M. N. A. 1857, 380, pl. 22, fig. 3 a–e.

Saccophorus? pineti, Fisch., Syn. 1829, 305.

Geomys pineti, Le C., these Proceedings, 1852, 159.

Pseudostoma floridana, Aud. & Bach., Q. N. A. iii. 1853, 242, pl. 150, fig. 1.

Geomys des pins, Desm., Mamm. ii. 1822, 314.

Southern Pouched Rat, *Gopher*, *Salamander*, Vulg.

Diag. Superior incisors with a main groove dividing the tooth into two unequal portions, the outer obviously the smaller; the inner larger moiety marked by a fine marginal groove, faint, obscure, and perhaps sometimes obsolete. Tail and hind feet in adult life naked or nearly so. Otherwise like *G. bursarius*.

Hab. Georgia, Florida, and Alabama.

[1] Detailed descriptions, discussions, and synonymy, and all general matters, are deferred.

[2] N. B.—Ord's *Mus tuza*, l. c., quoted with a query by Baird, unquestionably belongs to this species, being based solely on Mitchell's "Hamster of Georgia;" and antedates Rafinesque's name.

. **Geomys castanops** (Baird), Le C.

Pseudostoma castanops, Bd., Stansbury's Rep. G. S. L. 1852, 313.—Aud. & Bach., Q. N. A. iii. 1854, 304.

Geomys castanops, Bd., these Proceedings, 1852, 163; Baird, M. N. A. 1857, 381; P. R. R. Rep. x. 1859, Gunnison & Beckwith's Route, mammals, 8, pl. 10, f. 2.

Geomys clarkii, Baird, these Proceedings, 1855, 332; M. N. A. 1857, 383, pl. 50, figs. a–g.

Chestnut-faced and Pecos Gopher, Baird, ll. cc.

Diag. Superior incisors with a single median groove exactly bisecting the face of the tooth. Forefeet shorter or not longer than the hinder. Color pale yellowish-brown above, inclining more or less to dull chestnut anteriorly, whitish below; size of *G. bursarius*, or rather less. Fur soft, as usual in the genus.

Hab. Texas and New Mexico.

4. **Geomys mexicanus** (Licht.), Le C.

Ascomys mexicanus, Licht., Abh. Acad. Wiss. Berl. 1827, 113.

Saccophorus mexicanus, Fisch., Syn. 1829, 305.

Geomys mexicanus, Le C., these Proceedings, 1852, 160.—Baird, M. N. A. 1857, 387.

Pseudostoma (*Geomys*) *mexicana*, Aud. & Bach., Q. N. A. iii. 1854, 309.

Geomys (*Saccophorus*) *mexicanus*, Gieb., Säug. 1855, 529.

? *Tucan* of Hernandez.—*Tuça* or *Tuza*, Mexican.

Diag. Superior incisors bisected by a single median groove (as in *castanops*, which is very different in color). Coloration and general appearance of *G. bursarius* (which has bisulcate incisors). Fur soft and sleek (as in other species of the genus excepting *G. hispidus*). Averaging much larger than either of the United States species (about equalling *G. hispidus*), with proportionally smaller pouches and hands, and weaker claws. Tail and feet hairy (as is usual in the genus, not as in *G. tuza* or *G. hispidus*).

Hab. Mexico. (Limits of its distribution not known.)

5. **Geomys hispidus**, Le C.

Geomys hispidus, Le C., these Proceedings, 1852, 158.—Baird, M. N. A. 1857, 386, pl. 22, f. 4 a–d.

Pseudostoma (*Geomys*) *hispidus*, Aud. & Bach., Q. N. A. iii. 1854, 306.

Saccophorus quachil,[1] Gray, P. Z. S. xi. 1843, 79 (Coban, Centr. Am.; descr. nulla.).—Gerr., Cat. Bones Br. Mus. 1862, 223.

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[1] I do not find that this species, named in 1843, was ever described. Desiring to find out what it was, I wrote to Mr. R. B. Sharpe of the British

Diag. Superior incisors with a single strong deep groove lying wholly in the inner half of the tooth. Tail and hind feet naked or nearly so. Forefeet, including claws, decidedly shorter than the hind feet. Pouches moderate, reaching scarcely or not beyond the head. Pelage peculiarly stiff, harsh, coarse and nearly lustreless. Color uniform dull chocolate-brown, merely paler below. Of largest size; upward of a foot long; tail only about 3 inches; sole of hind foot 1.66.

Hab. Parts of Mexico, and Central America.

II. Genus **THOMOMYS**, Maxim.

Oryctomys, *pt.*, Eyd. and Gerv., Mag. Zool. vi. 1836, 23.
Thomomys, Maxim., N. Act. Ac. C. L. xix. 1839, 383.

In addition to the foregoing, all the synonyms of *Geomys* (*q. v.*) have been applied to species of this genus.

It is impossible to diagnosticate more than two species of this genus. The expressions used, therefore, to distinguish the three intergrading geographical races of *T. talpoides*, in the following analysis, must be understood to indicate only the normal average of the three forms, perfectly intermediate examples of each of which are found.

Analysis of Species.

A. Large; adults at least six inches long, usually more. Hind foot an inch or more long. Tail at least one-third as long as head and body. Above brown, reddish, etc, ; below gray, brown, reddish, etc. (not white). Ears set in a blackish area. 1. TALPOIDES.

a'. Six or eight inches long. Fore claws highly developed (0.45–0.50 long) causing the hand to about equal the foot in length. Color of the house rat, with white tail and feet; usually white about the mouth. Northern Interior. *a. talpoides.*

b'. Seven to nine inches long; fore claws less developed, usually under 0.50, leaving the hand shorter than the foot; reddish-brown, the belly muddy brownish; tail and feet usually not entirely white; mouth-parts dark, contrasting with the white of the pouches. Pacific coast, U. S. *b. bulbivorus.*

c'. Averaging smaller; usually six to seven inches long. Fore claws about 0.40 long, leaving the hand decidedly shorter than

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Museum, who, with his usual courtesy, examined Gray's type for me, and found it to agree exactly with the diagnosis I sent him of *G. hispidus.* In this identification he is supported by Mr. Gerrard, who examined the original specimen with him.

the foot. Rich fulvous, or even fawn-color, similar below but paler, variously obscured on the back with dusky ; tail and feet usually dark ; face and mouth-parts sooty-blackish, strongly contrasting with white pouch lining. Southern Interior and lower California. *c. umbrinus.*

B. Small ; decidedly less than six inches long. Hind foot less than an inch, fore foot still less. Tail scarcely one-fourth as long as head and body. Above, pale yellowish-gray, with a shade of light brown ; below, entirely white ; feet and tail white. Ears minute, not set in a blackish area ; end of snout blackish. Bridger's Pass, R. Mts. 2. CLUSIUS, *n. s.*

1. **Thomomys talpoides** (Rich.), Baird.

Cricetus talpoides,[1] Rich., Zool. Journ. iii. App. 1828, 518.
Geomys talpoides, Rich., F. B. A. i. 1829, 204.
Saccophorus talpoides, Fisch., Syn. 1829, 588 (marked "388"). (Compiled.)
Ascomys talpoides, Wagn., Suppl. Schreb. iii. 1843, 390. (Compiled.)
Pseudostoma talpoides, A. and B., Q. N. A. iii. 1853, 43, pl. 110. (Compiled.)
Geomys (Thomomys) talpoides, Gieb., Säug. 1855, 530. (Compiled.)
Thomomys talpoides, Baird, M. N. A. 1857, 403. (Compi ed.)
Geomys borealis, "Rich.," Bach., Journ. Phila. Acad. 1839, 103.
Ascomys borealis, Wagn., Suppl. Schreb. iii. 1843, 391. (Compiled.)
Saccophorus borealis, Gray, List Mamm. Br. Mus. 1843, 149. (Mere mention.)
Pseudostoma borealis, A. and B., Q. N. A. iii. 1853, 198, pl. 142.
Thomomys borealis, Baird, M. N. A. 1857, 396, pl. 22, figs. 2 a–e.
Geomys townsendii, Bach., Journ. Phila. Acad. 1839, 105.
Ascomys townsendii, Wagn., Suppl. Schreb. iii. 1843, 391. (Compiled.)
Thomomys rufescens, Maxim., N. Act. Ac. C. L. xix. 1839, 383.—Bd. M. N. A. 1857, 397.
Ascomys rufescens, Wagn., Suppl. Schreb. iii. 1843, 387. (Compiled.)
Geomys rufescens, Le C., these Proceedings, 1852, 161.
Geomys (Thomomys) rufescens, Gieb., Säug. 1855, 530.
Thomomys "fulvus," Merr., U. S. Geol. Surv. Terr. for 1872, 1873, 665, *lapsu.*
"*Geomys unisulcatus*, Gray, Mus. Brit."

Char. mediocr. Coloration almost exactly like that of the house rat, *Mus decumanus ;* sometimes assuming a more reddish phase, occasionally blackish-plumbeous ; tail and feet white, and

[1] Although this name is of frequent occurrence in the books, no author has hitherto identified it ; all the accounts are compiled. The only advance upon Richardson's original description is Audubon's figure of the type specimen.

much of the chin, throat, and breast also white in irregular patches, where the fur is white to the base. No sooty blackish about the mouth-parts; no obvious distinction in color between the pouch and its surroundings; no strongly pronounced reddish-brown on the under parts. General tone of coloration not decidedly tawny. Ears set in a small blackish area. Length 6–8 inches; tail 3 inches or less, decidedly less than half the length of the head and body. Fore and hind feet, claws included, approximately equal to each other, about 1.25; longest fore claw little less than the length of the rest of the hand, about 0.50.

(*Obs.* The foregoing are the average subspecific characters of this geographical race as distinguished from the next, with which it intergrades.)

Hab. Supposed to occur in the interior of North America from "Hudson's Bay" to the "Columbia River," and to occupy about the northern half of the United States west of the Mississippi, exclusive of the Pacific coast region—being replaced there by *T. bulbivorus*, and to the south by *T. umbrinus*. (Specimens examined from the Assiniboine country; from Selkirk Settlement; from Minnesota westward along the parallel of 49° N. to the Rocky Mountains; and from Idaho, Wyoming, Utah, and Nevada.)

1*a*. **Thomomys talpoides bulbivorus** (Rich.), Coues.

Diplostoma? bulbivorum, Rich., F. B. A. i. 1829, 206, pl. 18 B. (Lettered "douglasii.")
Ascomys bulbivorus, Wagn., Suppl. Schreb. iii. 1843, 387. (Compiled.)
Geomys bulbivorus, Lec., these Proceedings, 1852, 162. (Compiled.)
Pseudostoma bulbivorum, A. & B., Q. N. A. iii. 1854, 337. (Compiled.)
Geomys (Thomomys) bulbivorus, Gieb., Säug. 1855, 530. (Compiled.)
Thomomys bulbivorus, Baird, M. N. A. 1857, 389, pl. 50, f. 3 a–g, pl. 52, f. 1 a–g.
Geomys douglasii, Rich., F. B. A. i. 1829, 200, pl. 18 C, f. 1-6.
Ascomys douglasii, Wagn., Suppl. Schreb. iii. 1843, 392. (Compiled.)
Pseudostoma douglasii, Aud. & Bach. Q. N. A. iii. 1853, 24, pl. 105.
Geomys (Thomomys) douglasi, Gieb., Säug. 1855, 531. (Compiled.)
Thomomys douglassii, Bd. M. N. A. 1857, 394.
Oryctomys (Saccophorus) bottæ, Eyd. & Gerv., Mag. Zool. vi. 1836, 23, pl. 21, f. 4.
Thomomys bottæ, Less., Nouv. R. An. 1842, 119. (Compiled.)
Geomys fuliginosus, Schinz, Syn. ii. 1845, 136. (Mere change of name.)
Thomomys laticeps, Baird, these Proc. 1855, 335; M. N. A. 1857, 392.

Char. mediocr. Coloration stronger than in the foregoing—general cast reddish-brown, lined with dusky on the back, the head usually darker than the rest of the upper parts; on the sides the color giving way to a clearer tawny-brown, which also occupies the belly, there overlying the plumbeous roots of the hairs as a strong wash. Face and mouth parts dusky, or even sooty, blackish, contrasting with the white lining of the cheek pouches. No pure white on the under parts. Tail and feet usually incompletely whitish, or quite dusky. If anything, averaging rather larger than true *talpoides*. Hand rather shorter than the foot, owing to less development of the claws, the longest of which is only about 0.40 long.

Hab. Pacific slopes and coast of the United States from Washington Territory to Southern California. In the north shades directly through "*douglasii*" into typical *talpoides*, and in the opposite direction intergrades completely with *umbrinus*.

1*b*. **Thomomys talpoides umbrinus** (Rich.), Coues.

Geomys umbrinus, Rich., F. B. A. i. 1829, 202. ("Louisiana.")
Ascomys umbrinus, Wagn., Suppl. Schreb. iii. 1843, 389. (Compiled.)
Pseudostoma umbrinus, A. & B., Q. N. A. iii. 1854, 307. (Compiled.)
Geomys (*Thomomys*) *umbrinus*, Gieb., Säug. 1855, 530. (Compiled.)
Thomomys umbrinus, Bd., M. N. A. 1857, 399.
Geomys fulvus, Woodh., these Proceedings, 1852, 201.
Pseudostoma (*Geomys*) *fulvus*, A. & B., Q. N. A. iii. 1854, 300. (Compiled.)
Thomomys fulvus, Bd., M. N. A. 1855, 402.

Char. mediocr. Averaging decidedly smaller than either of the foregoing. Length of head and body little over six inches. Fore-feet averaging decidedly less than the hind feet; longest claw oftener under than over 0.40. Color varying from a nearly uniform rich fulvous, or even intense reddish-chestnut, to various tawny-brown shades, with or without a blackish dorsal area. Belly usually merely a paler shade of the color of the upper parts, or much as described under *bulbivorus*. Occasionally quite gray, as a typical *talpoides*. (Varies also to a lustrous coal-black all over.) Mouth parts and often whole face blackish, except sometimes just around the mouth, sharply contrasting with pure white lining of the pouches. Tail usually not white.

Hab. S. Colorado, S. Utah, S. Nevada, W. Texas, all of New Mexico, Arizona, and Lower California to Cape St. Lucas. Southward extension into Mexico undetermined. "Louisiana."

2. **Thomomys clusius,**[1] Coues, n. s.

Char. Spec. Smallest known species of the genus; length of an adult ♀ about 5 inches. Feet remarkably small; sole 0.75; palm, including longest claw, 0.65. Fore-claws small, little curved, the longest under 0.30. Tail extremely short; under 1.50 in length from the true base, and little over 1.00 from the end of the conical enlargement at base, the scant-haired portion being thus less than one-fourth of the total length of head and body. Ears minute. Color above pale yellowish-gray, with a slight brown shade, the fur plumbeous at base as usual. Below, nearly pure white to the very base of the fur. No dark auricular area. Feet and tail white. Extremity of snout blackish.

Hab. Type No. 3051, Mus. Smiths. Inst., Bridger's Pass, Rocky Mountains, July 21, 1857, Dr. W. A. Hammond.

[1] Name given in allusion to the characteristic habit of animals of this family, of plugging up the entrances to their subterranean tunnels.

DESCRIPTIONS OF A NEW FOSSIL SHELL FROM PERU.

BY T. A. CONRAD.

OSTREA, Lin.

O. callacta, Pl. 22, fig. 1.

Suborbicular, compressed, profoundly and equally plicated on both valves; folds rounded, wide, elevated, about 8 in number; upper valve concave on the umbo, entire towards the apex, concentric lines thick and prominent.

Locality.—" This shell was picked up at the confluence of the Pachitea and Pichis rivers, which flow through the Pampa del Sacramento in Eastern Peru." Dr. Galt.

Having seen one specimen only, it may be found to vary in the number of ribs.

Dr. Galt brought this fine specimen from Peru and presented it to the Academy of Natural Sciences.

It probably comes from the Pebas group.

ACICULA ? Risso.

A. ——— Pl. 22. fig. 2.

This appears to be a young shell allied to the Glandina forms. As there is one specimen only, and that very young, I am unable to state whether it be undescribed or not. Prof. Orton found it at Villa Bella.

ON THE JAW AND LINGUAL MEMBRANE OF NORTH AMERICAN TERRESTRIAL PULMONATA.

BY W. G. BINNEY.

In his work on the "Terrestrial Air-breathing Mollusks of the United States," my father paid great attention to the jaws and lingual membranes, figuring those of all the species which he could obtain. In continuing my father's labors on the same subject, I have described and figured those of many other species. Thus, in a certain sense, it may be said that a great deal is known of these organs in our land shells. Unfortunately, however, these figures and descriptions have become of comparatively little value now that the study of this subject has assumed such importance. They do not give in sufficient detail the character of the individual teeth, however correct an idea they may give of the general arrangement of the teeth upon the membrane. I have, therefore, been induced to review the whole subject, and present it in a manner which will be of value as throwing light upon classification.

The following pages contain the result of my re-examination of the lingual membranes collected by me during the last thirty years. I regret that the collection is not more perfect, but there seems little chance of my making it more so, especially as to the rarer and more inaccessible species. I have decided, therefore, to publish at this time what material I have.

Before commencing my description, I will give some general remarks on the organs treated of in my paper, and on their value for the purpose of classification, and on the bibliography of the subject.

General Remarks.

As many of my readers are quite unfamiliar with the subject, especially most of those who have so largely contributed specimens for examination, I will describe in detail the position of the organs and the method adopted for their study.

On holding up against the light an individual of *Helix thyroides* in one hand, and offering to him with the other some food (a piece of carrot is always acceptable), one can readily see with the naked eye the two organs here treated of. Above the external opening of the mouth, through the transparent tissue of the head, is seen a small, arched, reddish, free instrument, which appears to rise and fall as if used in cutting off morsels of food. This is the jaw.

On the floor of the mouth is the lingual membrane, occupying about the position of the human tongue. Its color is too nearly the same as that of the head to afford any strong contrast, but, with close attention, it will be detected by its glistening silvery appearance, as it works backward and forward.

The use of the tongue seems to be to rasp the food and also to force it back into the œsophagus.

More detailed description, fully illustrated by figures, of the position of these two organs, will be found in the chapters on Special Anatomy in the first volume of the "Terrestrial Air-breathing Mollusks of the United States."

Method of Extraction.

On opening the head of *Helix thyroides* from above, one readily notices at the extreme anterior part, close against the outer integument, a prominent oval body. This is called the buccal mass. It is easily cut away from the animal, and will be found to contain both jaw and lingual membrane. They can be removed by fine scissors or knives from the buccal mass in the larger species, but in the smaller species, the method usually employed is putting the whole buccal mass in a watch crystal full of a strong solution of caustic potash. Allowing it to remain for several hours, the potash will destroy all of the buccal mass, and leave the jaw and lingual membrane perfectly clean and ready for examination. They remain attached, if the solution is not too strong, showing a connection between the two. They must first be well rinsed in clean water, in another watch crystal, before examination. Another more expeditious process is to place the whole buccal mass in a test-tube, with the solution of potash, and boil it for a few seconds over a spirit lamp. Pouring the contents of the test-tube into a watch crystal, the lingual membrane attached to the jaw will be readily seen by a pocket lens. If the species be very small, as *Paluta striatella* for instance, its whole body may be thrown into the solution. Still more minute species, as *Zonites milium* for instance, may be treated in this way: crush the whole shell between two glass slides, wash away the particles of the broken shell in a few drops of water, still keeping the body of the animal on the slide; when clean, drop on it the caustic potash and boil it by holding the slide itself over the spirit lamp.

On Mounting.

For the purpose of examination, the jaw and lingual membrane may be simply mounted in water and covered with thin glass. One must be sure to spread out the lingual membrane, not have its upper side down, and it will be well to cut it transversely in several places, as the teeth are beautifully shown, and often stand detached, on the edges of the cut.

For preservation for future study I hesitate to recommend any process, as I know of none which has been tried for a sufficiently long time. I have myself lost many specimens by imperfect mounting. Canada balsam, formerly used, ruins the membrane by rendering it too transparent. The glycerine mounting fluids, now in use, certainly preserve a membrane for several years, but they have not been tried many years.

On the Jaw.

The jaw and lingual membrane, having been mounted, must now be examined under the microscope.

The jaw will be found to vary greatly in its characters in the different genera. It is either in one single piece (pl. XVI., fig. 1); in one single piece with an accessory quadrate piece attached to its upper margin; or in separate, detached pieces, free on their lower edges, usually soldered together into one single piece above (pl. XVI., fig. 13). It differs also in being with (pl. XVI., fig. 3), or without (fig. 6) a median beak-like projection to its cutting edge; also in its ends being more or less acuminated; but still more by the presence or absence of striæ or rib-like processes on its anterior surface. When present, the ribs are found in every degree of development, passing quite across the jaw and denticulating one or both margins (pl. XVI., fig. 8), or only developed on the lower portion of the jaw, and crenellating the lower margin. The ribs are often almost obsolete, or represented by wrinkles or coarse striæ. They are present on the anterior surface of the jaw only, or on both anterior and posterior surfaces. They are distant, narrow, stout, few (fig. 8); or crowded, broad, stout, and numerous (fig. 14). Their number is within certain limits inconstant in the same species. They sometimes are very broad, and seem like separate plates soldered to the anterior surface of the jaw, or to be formed by a folding of the jaw upon itself (fig. 12). When this appearance of folding into plates is given, it will generally be found that the plait-like sections are actually separated by distinct, but delicate ribs. When this form of ribs is found, they are either vertical or inclined obliquely towards the median line of the jaw. Sometimes this last arrangement is developed to such a degree that the delicate ribs meet before reaching the bottom of the jaw, and a triangular compartment is left at the upper centre of the jaw, its base being upward (fig. p.). This form of jaw is usually thin and membranous.

When the jaw is striated and not ribbed, the striæ are vertical, or they converge towards the median line (fig. p.). There are often transverse striæ also, and transverse lines of re-enforcement (pl. XVI., fig. 3).

The upper margin of the jaw is often extended into a stout membranous attachment, apparently of the same material and consistency as the jaw itself, and showing the same continuity of structure by the striæ of the jaw extending into it without interruption. This is not the accessory quadrate plate mentioned above.

The jaw is found in every degree of consistency, from very thick to quite membranous and almost transparent.

The cutting margin of the jaw is smooth, crenellated, or denticulated. It is simply concave, or furnished with a more or less developed beak-like median projection.

In shape the jaw ranges from scarcely arcuate, long, low, to horseshoe-shaped, short, high.

It will be seen below that these peculiarities of the jaw, taken in connection with the characters of the lingual membrane, appear to furnish reliable characters for classification.

The Lingual Membrane.

In placing the lingual membrane under the microscope, we at once perceive that it is (at least in most of our genera) a long,[1] narrow, ribbon-like organ, whose whole surface is covered with numerous small tooth-like processes, whose reflected apices are pointed, the points directed towards the œsophagus, to which, as stated above, they serve to move the food, as well as to perform a rasp-like mastication. These teeth are arranged in two series of rows, one running longitudinally, the other transversely.

On careful examination it will be seen that all the teeth of each successive longitudinal row are of the same form,[2] but that there are several types of teeth in the different parts of each transverse row. Three of these types are found, the *central* tooth, the teeth on either side of the central, called *laterals*, and the teeth extending from the laterals to the outer margins of the membrane, called *marginals*. The change from the single central to the laterals is usually abrupt, but from the laterals to the marginals it is usually gradual, so that there are several teeth intermediate between the two, which may be called *transition* teeth. The transverse rows of teeth are similar on each side of the central tooth, so that it is necessary to figure only one-half of one transverse row with its central tooth to give an idea of the whole transverse row, or indeed, of the whole membrane, as all the longitudinal rows, as stated above, have similar teeth.

These transverse rows differ in the various genera as to their direction, either straight, oblique, or curving, or a combination of these directions.

Of the three types of teeth, central, lateral, and marginal, one or more may be wanting. Their number, however, is approximately constant in different individuals of the same species, so that, as a specific character, the count of the teeth on one transverse row is usually given; thus in *Zonites inornatus* I find about

[1] It is very broad in *Orthalicus Liguus*, some subgenera of *Achatinella*, some *Bulimuli*, etc.; in some subgenera of *Cylindrella* it is very narrow.

[2] Even in case of malformation this holds true. I have often found a misshapen, or otherwise abnormal tooth, repeated down the whole length of the membrane, or even that a tooth may be entirely wanting in its whole length.

23—1—23 teeth, that is, 23 teeth on each side of the central tooth, making 47 teeth in the entire transverse row.

The characters of the individual teeth vary greatly in the various genera, especially in some of the genera foreign to our limits. In most cases, however, there are two distinct types of teeth, the *quadrate* and *aculeate*. The former is shown in pl. III., fig. 12, *a*, *b*, *c*, *d*, is the portion of the tooth which rests upon the membrane; I have called it the *base of attachment*. It varies in its proportional length, and in the greater or less expansion of the lower[1] lateral angles. The upper margin of this base of attachment is broadly reflected; *e* marks the reflected portion, which I term the *reflection*. It is usually tricuspid, the *median cusp h* being much longer than the side *cusps f f*. These last are subobsolete in the species figured, but in figure 7 *a* of the same plate these side cusps are more fully developed. All the cusps are in most cases surmounted by distinct *cutting points*; *i* is the *median* cutting point, *g g* the *side* cutting points. These cutting points are not always present on the side cusps, and, even when present, are sometimes not readily detected. Indeed, this is the most difficult point of study of the whole membrane. The cusps and cutting points vary in development in the various species, and somewhat so in different portions of the same membrane.

The other type of tooth (pl. XVII., fig. 3 *b*), which I call *aculeate*, differs in not having a quadrate base of attachment, but usually one of a somewhat sole-like form. Its upper margin is not reflected, but from its whole surface springs a single large cutting point, usually thorn-shaped, but sometimes more spine-shaped. The apex of the cutting point is sometimes bifid, or even trifid, even in the same genus.

Of these two types, quadrate and aculeate are all the teeth now known. Of the quadrate type many and dissimilar forms are known, but all have the quadrate base of attachment.

The characteristics of central, lateral, and marginal teeth are given under each genus or subgenus.

[1] I use the term *upper* and *lower* to describe the figure I give of the base of attachment. More properly I should say *posterior* and *anterior* to describe their position on the membrane.

On Classification.

The characters of the jaw, combined with those of the lingual membrane, furnish reliable bases of classification. They have been considered of various weight by different writers. I here propose to treat them as guides only to the greater division of the Pulmonata.[1] In grouping the various genera it will be necessary to include *all*, both American and foreign to America, in order to properly appreciate the value of this grouping.

Taking, therefore, the whole series of known terrestrial Pulmonata, the first grand division is based on the presence or absence of a jaw. Of the former are the following: *Testacella*,[2] *Daudebardia*,[3] *Streptaxis*,[4] *Rhytida*,[5] *Diplomphalus*,[6] *Strebelia?*[7] *Glandina*,[8] *Petenia?*[9] *Spiraxis?*[10] *Streptostyla*,[11] *Ravenia?*[12] *Strepstostele*,[13] *Cæliaxis?*[14] *Gonospira*,[15] *Gibbus?*[16] *Ennea*.[17]

All the above have aculeate marginal teeth; the lateral teeth are always absent; the centrals in some of the genera.

The following genera have quadrate marginal teeth: *Onchidium*,[18] *Onchidella*,[19] *Peronia*,[20] *Buchanania?*[21]

[1] I must not be understood to propose a system of classification. I merely place the genera into certain groups, independent of their divisions into families.

[2] Heynemann, Malak. Blatt. X., pl. II., fig. 5.

[3] Goldfuss verh. Naturh. Vereins der preuss. Rheinl. und Westphalens, 13th year, 1856, pl. VI., fig. *c*. *c*[1].

[4] Heynemann, Malak. Blatt. XV., pl. IV., fig. 2.

[5] Semper, Nachr. der deut. Malak. Gesellschaft II., 102.

[6] Fischer and Crosse, Journ. de Conch. XXI., 21, pl. III., fig. 8.

[7] Jaw and dentition unknown.

[8] See this paper.

[9] Jaw and dentition not actually known.

[10] Jaw and dentition not actually known; as restricted, the genus may be more correctly placed near *Stenogyra*.

[11] Fischer and Crosse, Moll. Mex., p. 16, pl. IV., fig. 2.

[12] Jaw and dentition not actually known.

[13] Heynemann, Nachr. mal. Gesel. I. 20, 177, fig. 5.

[14] Jaw and dentition not actually known.

[15] Bland and Binney, Amer. Journ. Conch. V. 37, pl. XI. fig. 1, photographed.

[16] No doubt like the last.

[17] Heynemann, Nach. mal. Gesel. I. 20, 177, pl. XX., figs. 3, 4.

[18] Bland and Binney, Ann. Lyc. N. H. of N. Y. X., p. 340, pl. XVI., figs. 3–5.

[19] Heynemann, Malak. Blatt. X., pl. III., fig. 13.

[20] Quoy, Voy. de l'Astrolabe, pl. XII.

[21] Jaw and lingual unknown.

The second grand division contains those genera having a jaw. In this division also we find some genera with aculeate, and some with quadrate, marginal teeth.

Of the former are: *Limax*,[1] *Ibycus*,[2] *Parmacella*,[3] *Tennentia*,[4] *Mariella*?[5] *Parmarion*,[6] *Dendrolimax*,[7] *Phosphorax*?[8] *Urocyclus*?[9] [I know nothing of the position of *Othelosoma*, *Aspidorus*, and other problematical genera.] *Vitrina*,[10] *Vitrinoidea*,[11] *Vitrinopsis*,[12] *Nanina*,[13] and all the genera now recognized in its disentegration, *Stenopus*,[14] *Vitrinoconus*,[15] *Macrocyclis*,[16] *Zonites*.[17]

The following genera have quadrate marginal teeth. They may be readily grouped by the character of their jaw, which is either in one single piece, in one single piece with an accessory upper quadrate piece, or in numerous pieces.

Those whose jaw is in one single piece may again be subdivided into several groups based on the absence, presence, and peculiarities of the ribs on their jaw. This division, however, is unsatisfactory, as these characters are not always well marked.

(*a*) Jaw without ribs: *Philomycus*,[18] *Parmella*?[19] *Oopelta*,[20] *Anaderus*,[21] *Sagda*,[22] *Patula*,[23] *Polymita*,[24] *Hemitrochus*,[25] *Helicodiscus*.[26]

1 See this paper.
2 Heynemann, Malak. Blatt. X. 142, pl. I., fig. 3.
3 Semper, Phil. Archipell. 90.
4 Semper, l. c. 1, pl. VI., fig. 17.
5 Ib. 12.
6 Ib. 9, pl. VI., fig. 16.
7 Heynemann, Malak. Blatt. XV., pl. I., fig. 1.
8 Jaw and tongue not known.
9 Heynemann, Malak. Blatt. 1866, 70, pl. XI., as *Parmarion flavescens*.
10 See this paper.
11 Semper, l. c. 85, pl. IX., fig. 33.
12 Ibid. 86, pl. XI., fig. 26.
13 Ibid.
14 Bland, Ann. Lyc. N. H. of N. Y., VIII., 158, fig.
15 Semper, 1 c., 91, pl. XI., fig. 27.
16 See this paper.
17 See this paper.
18 See this paper.
19 Jaw and lingual dentition unknown.
20 Heynemann, Malk. Blatt. XIV., pl. I., 2.
21 Heynemann, Malk. Blatt. X., 138, pl. I., fig. 1.
22 Bland and Binney, Am. Journ. Conch. VI., 177.
23 See this paper.
24 Bland and Binney, Ann. Lyc. N. H. of N. Y., X., 341, pl. XVI., fig. 1.
25 See this paper.
26 See this paper.

Acavus, *Corilla*, *Caryodes*, *Panda*, *Labyrinthus*, *Caracollus*,[1] *Leucochroa*,[2] *Cysticopsis?*[3] *Plagioptycha*,[4] *Leptoloma*,[5] *Anostoma*,[6] *Anostomella?*[7] *Tomigerus? Boysia? Plectostoma? Hypselostoma?*[8] *Achatinella*,[9] *Clausilia*,[10] *Stenogyra*,[11] *Strophia*,[12] *Buliminus*,[13] *Balea*,[14] *Pupa*,[15] *Vertigo*,[16] *Ferussacia*,[17] *Cæcilianella*,[18] *Geostilbia? Azeca? Tornatella?*[19] *Zospeum?*[20] *Holospira*,[21] *Eucalodium*[22] *Cælocentrum*,[23] *Lithotis*,[24] *Rhodea*, *Megaspira*,[25] *Limicolaria*,[26] but one species has a ribbed jaw, *Achatina*,[27] *Pseudachatina? Perideris? Columna?*[28] *Bulimus* as now constituted has various forms of jaw.

(*b*) Jaw with decided stout ribs: *Arion*, *Ariolimax*, *Prophysaon*, *Pallifera*, *Veronicella*, *Binneia*, *Hemphillia*, *Helix*,[29] *Geomolacus*,[30] *Letournexia*,[31] *Peltella*,[32] *Xanthonyx*,[33] *Simpulopsus*,[34] *Pfeif-*

[1] See Semper, l. c. No doubt other genera of disintegrated *Helix* will be found to be grouped here. I propose at present to remove from *Helix* all the species not having ribs upon their jaw.

[2] Bland and Binney, Ann. Lyc. Nat. Hist. of N. Y., X., 220.

[3] Bland and Binney, Ann. Lyc. N. H. of N. Y., IX.

[4] Proc. Ac. Nat. Sc. Phila. 1874, 56. [5] Ibid. 58.

[6] Journ. de Conch., XIX., 261, pl. XI., fig. 4.

[7] Jaw and dentition unknown.

[8] Jaw and dentition unknown.

[9] Bland and Binney, Ann. Cyc. N. H. of N. Y., X., 335, pl. XV., figs. 6, 7.

[10] Troschel, Moquin-Tandon, Lehmann, etc.

[11] See this paper. [12] See this paper.

[13] But some species have ribs. See Moquin-Tandon, Lehmann, etc.

[14] Moquin-Tandon, Moll. Fr., pl. XXV., fig. 6.

[15] See this paper. [16] See this paper.

[17] See this paper. [18] See this paper.

[19] Unknown.

[20] Heynemann, Mal. Bl. X., pl. III., fig. 14. Jaw unknown.

[21] See this paper.

[22] See Crosse and Fischer, Journ. de Conch. 1870, pl. V., fig. 1.

[23] Jaw and dentition unknown.

[24] Binney, Proc. Phila. Ac. Nat. Sc. 1874, pl. V., fig. 3.

[25] Jaw and dentition unknown.

[26] Bland and Binney, Amer. Jour. Conch., VII., 181.

[27] Von Martens, ed. 2, p. 201.

[28] Jaw and dentition unknown. [29] See this paper.

[30] Bland and Binney, Ann. of Lyc. of N. H. of N. Y., X., 309, fig.

[31] Bourguignat, Moll. nouv. et lit. VII. 201, pl. XXXIV., fig. 1–7.

[32] Jaw apparently ribbed in Férussac's figure, pl. VII. A.

[33] Fischer and Crosse, Moll. Mex., pl. IX., figs. 15, 16.

[34] Shuttleworth, Diag., No. 6, p. 147.

feria,[1] *Berendtia*,[2] and, as stated above, some species now included in *Bulimus*, *Cochlostyla*, *Buliminus*, *Limicolaria*.

(*c*) Jaw with separate, delicate ribs, usually running obliquely towards the centre: *Gæotis*,[3] *Amphibulima*,[4] *Bulimulus*, *Cylindrella*, *Macroceramus*,[5] *Pineria*,[6] *Partula*.[7]

The genera whose jaw is in one piece with an accessory quadrate piece are *Succinea*,[8] *Omalonyx*,[9] *Hyalimax*,[10] *Athoracophorus*.[11]

The genera whose jaw is in separate pieces are *Orthalicus*, *Liguus*, *and Punctum*.[12] I have arranged the American genera in the same manner in the following pages.

Bibliography.

The principal works referred to are:—

LEIDY in Binney's Terrestrial Air-breathing Mollusks of the United States. Boston, 1851, Little & Brown. The wood-cuts of lingual membranes are misplaced in the text. See the list, vol. II. p. 358.

BINNEY and BLAND. Land and Fresh Water Shells of North America. Part I. Smithsonian Miscellaneous Contributions. Washington, 1869.

MORSE in Journal of the Portland Society of Natural History, 1864.

MOQUIN-TANDON. Histoire Naturelle des Mollusques Terrestres et Fluviatiles de la France. Paris, 1855.

FISCHER et CROSSE. Etudes sur les Mollusques Terrestres et Fluviatiles du Mexique et l'Amérique Centrale. Paris, 1874.

LEHMANN. Die lebenden Schnecken und Muscheln der Umgegend Stettins und in Pommern. Cassel, 1873.

1 Mörch, Journ. de Conch., 1865, 385.

2 Crosse and Fischer, Journ. de Conch. 1870, pl. V., fig. 11, 12.

3 Bland and Binney, Ann. Lyc. N. H. of N. Y., Vol. X., pl. XI., figs. 1, 5-7.

4 Proc. Phila. Ac. N. Sc. 1874, pl. VIII., figs. 2, 5, 6. *Pellicula* is a synonym of this.

5 See this paper.

6 Bland and Binney, Ann. N. Y. Lyc. N. H., X., 22.

7 Binney, Ann. Lyc. N. H. of N. Y., XI. 45.

8 See this paper.

9 Malak. Blatt. X., pl. IV., fig. 5, a.

10 Fischer and Crosse, Journ. de Conch. XV., 218, pl. X., figs. 5, 7.

11 Bergh, verh. kais. kœnig. zoolog. botan. Gesell. in Wien. XX. 844, pl. XII., fig. 2, 4, 5.

12 See this paper.

GOLDFUSS. Verzeichniss der bis jetzt in der Rheinprovinz und Westphalen beobachteten Land- und Wasser-Mollusken, nebst kurzen Bemerbrengen über deren Zungen, Krefer, und Liebesfeile. From Verhandlungen der natushistorischen Vereins der preussischen Rheinlande und Westphalens. 13 Jahrgang. Bonn, 1856.

SEMPER Landmollusken. Reisen in Archipel der Philippinen. Wiesbaden, 1873.

HEYNEMANN. Einige Miltkeilungen über Schneckenzungen mit besenderer Beachtung der Gattung Limax. From Malakozoologischer Blätter, X. 1862.

VON MARTENS Die Heliceen von JOH. CHRIST. ALBERS. Zweite Ausgabe. Leipzig, 1860.

These are the principal works referred to. The references to shorter papers in various periodicals will easily be understood.

ON MY ILLUSTRATIONS.

I have endeavored to give a good view of the central, lateral, and marginal teeth of each species, with the transition teeth of many of the species. The portion of the membrane chosen is different in the various species of each genus or subgenus, in order that the variations in the form and development of cusps, and cutting points may be shown. Thus on pl. III. fig. 1, *b*, I have selected the part of the membrane where the marginal teeth have a very blunt cusp, while in fig. 4, *b*, they are shown much more graceful. It must constantly be borne in mind that on any one membrane the teeth vary considerably in regard to this point.

In illustrating the general arrangement of the teeth upon the lingual membrane in each genus or subgenus, I have used the woodcuts in the text prepared for my former works and papers, mostly by Mr. Morse, and a few by Dr. Leidy, prepared for my father's work. It must be remembered that these figures do not represent correctly the characters of the individual teeth.

I have also used in the text figures of the jaws of many genera and subgenera, prepared for the Land and Fresh Water Shells of North America, Part I. The jaws of the more recently described genera and subgenera I have myself drawn by camera lucida in pl. XVI.

On the Value of the Jaw and Lingual Membrane for the purpose of Classification.

It is conceded by all recent students of land shells that for the larger divisions the presence or absence of a jaw, and the aculeate or quadrate form of marginal teeth are reliable characters.

The characters of the jaw and separate teeth of the lingual membrane have also been used in various ways for grouping the genera into families, etc., and even of grouping species into genera. I refrain from any discussion of their value for such purposes, simply because I believe our material is far too limited. It seems as if I can better employ my time in patiently accumulating new facts. I can, however, venture to say that the character of the jaw and teeth seems to be more constant in some genera than in others. It appears, for instance, that in some genera the presence or absence of lateral teeth is not a generic character, though in others it is.

The same may be said of the presence or absence of side cutting points to the centrals and laterals, and the greater or less development of their side cusps; also in the bifurcation or non-bifurcation of the cutting point of aculeate marginal teeth.

It will, I believe, be proved that certain genera are constantly characterized by peculiar form of teeth, while others have a considerable range of variation. I might, perhaps, add that when the genus is numerous in species, there is a much greater chance of finding a varying dentition. If this latter proves true, we shall be obliged to concede that there are certain types of teeth which may be found among species of some of the larger genera, though some of the smaller genera are much more, if not absolutely, restricted to one single type of dentition. I do not venture any further deductions at this time.

Before closing my paper I must return thanks to my many correspondents, who have furnished me specimens for examination during many years. I have already acknowledged their kindness while originally describing the jaw and lingual membrane of each species in the American Journal of Conchology, the Annals of the Lyceum of Natural History of New York, and the Proceedings of the Academy of Natural Sciences of Philadelphia. Most of those papers[1] were published in connection with my friend, Mr. Bland, without whose aid I never could have had the material to study lingual dentition, especially in the interesting forms foreign to the United States. He has also shown great interest in the progress of the present paper.

Finally, I must acknowledge my many obligations to my young friend, Mr. A. Ten Eyck Lansing, for his most valuable assistance in the preparation of my paper. His observations of most of the lingual membranes, independent of my own, have saved me from many errors, and rendered my work much more reliable.

I will add that all the figures in the plates have been drawn by my own hand from the microscope itself, with the aid of the camera lucida.

BURLINGTON, N. J., Oct. 1874.

A complete catalogue of the species found in North America, from the extreme north to the Rio Grande and to San Diego, here follows. An account of their geographical distribution has been published by me in the Bulletin of the Museum of Comparative Zoology, vol. iii. No. 9, Cambridge, 1873.

The sign † is affixed to the name of species whose jaw and lingual membrane are unknown.

PULMONATA GEOPHILA.

OLEACINIDÆ.

†**Glandina Vanuxemensis**, Lea.
truncata, Gmel.
†**decussata**, Desh.
†**Glandina bullata**, Gld.
†**Texasiana**, Pfr.

HELICIDÆ.

VITRININÆ.

Macrocyclis Vancouverensis, Lea.
†**sportella**, Gld.
concava, Say.
Macrocyclis Voyana, Newc.
Duranti, Newc.

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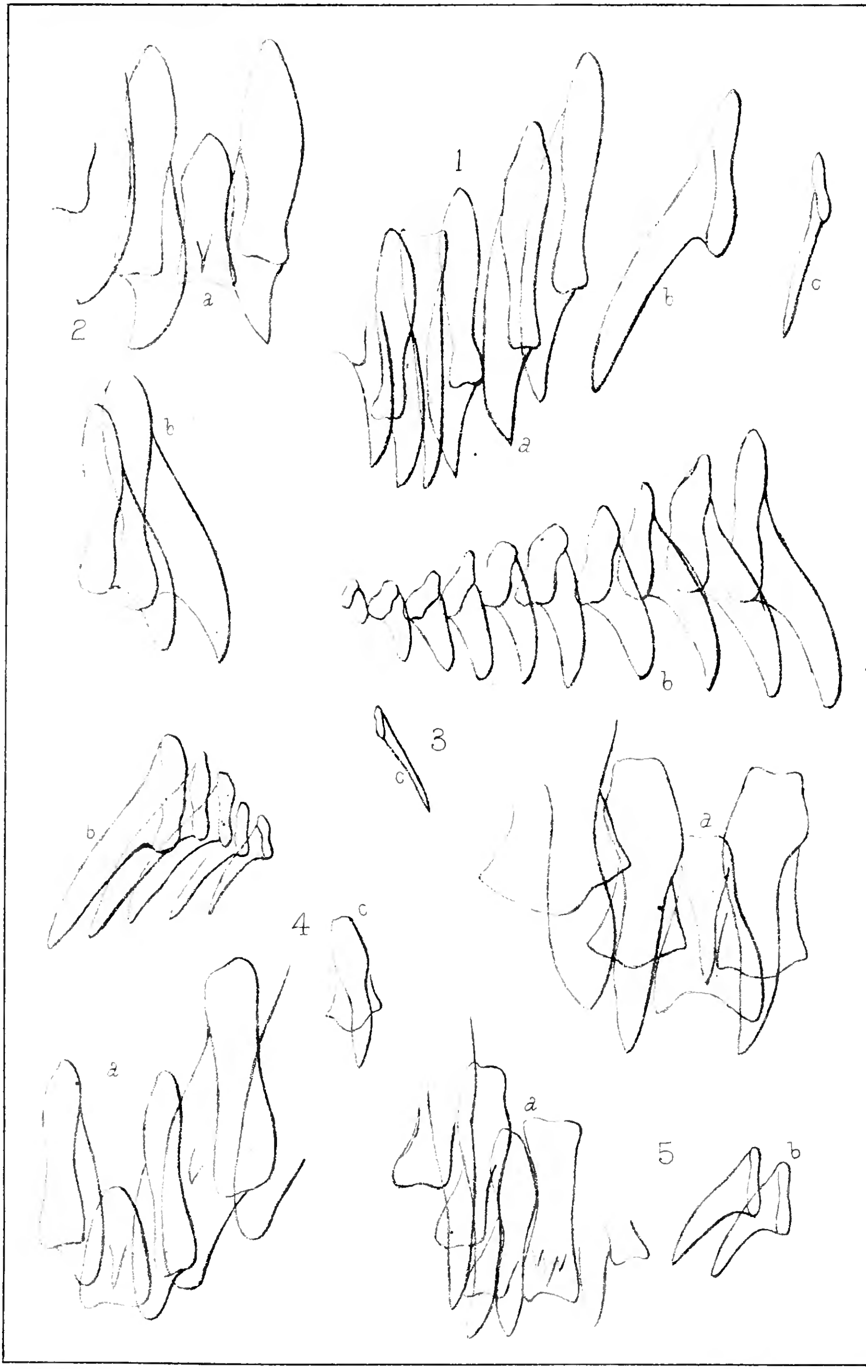
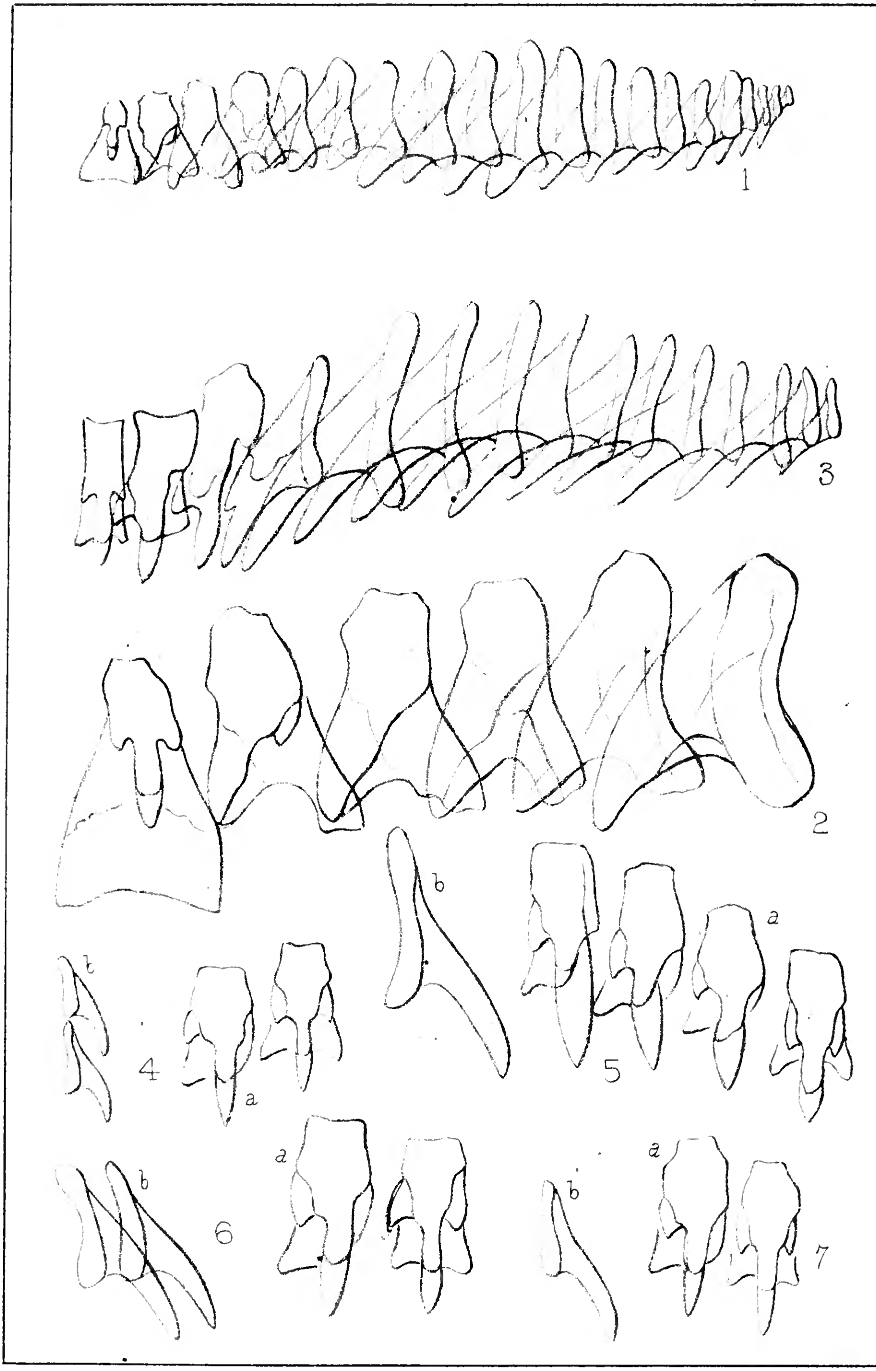
[1] A complete list of all these papers may be had of the American Naturalist Agency, Salem, Mass.

Plate I.



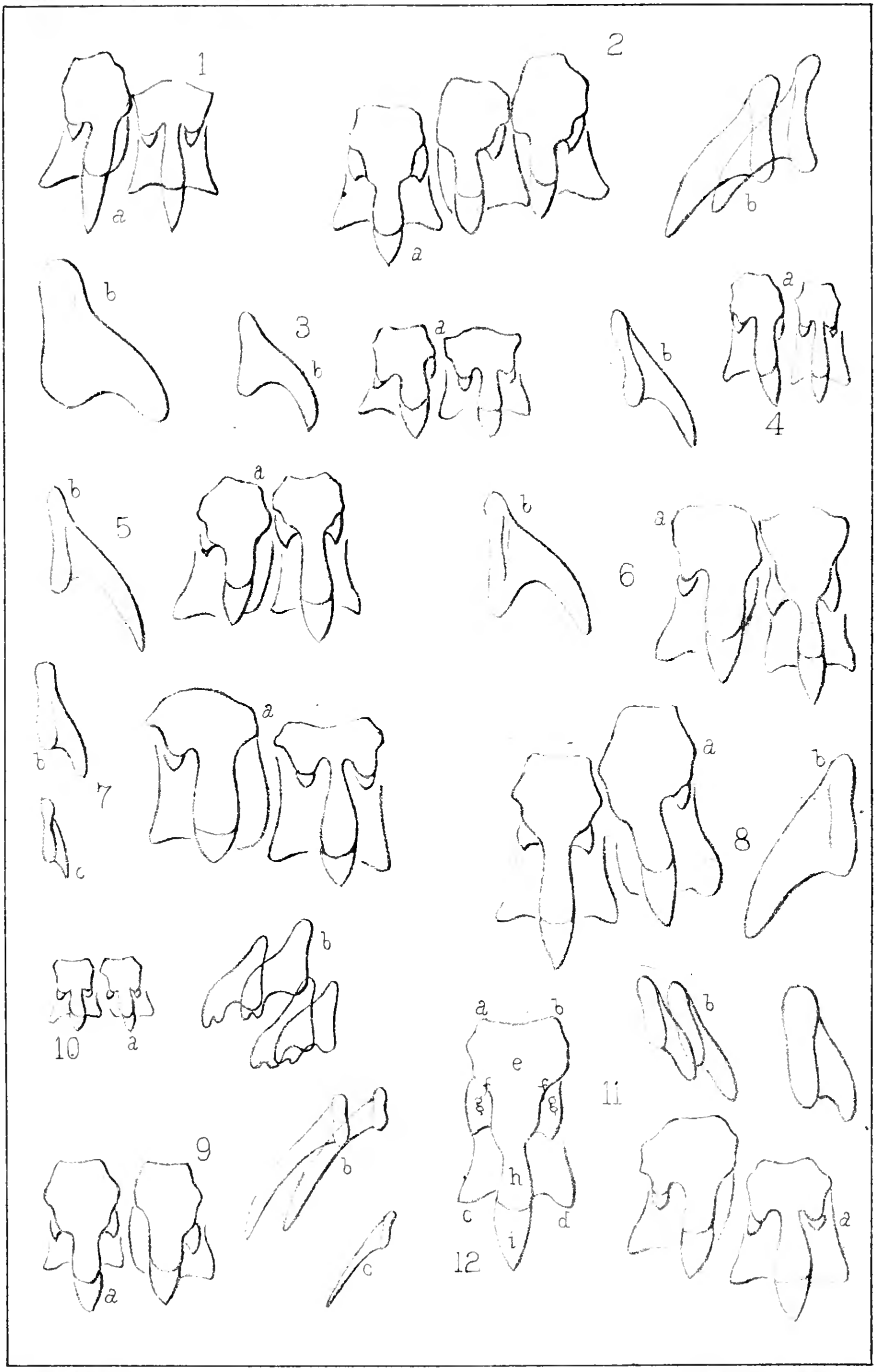
1. [illegible] 3. M. [illegible] concava [illegible]
2. M[illegible] Durant[illegible] 4. M. [illegible]
5. M. Veyana [illegible]



W. G. B. del.

J. H. Bufford's Sons Lith. Boston.

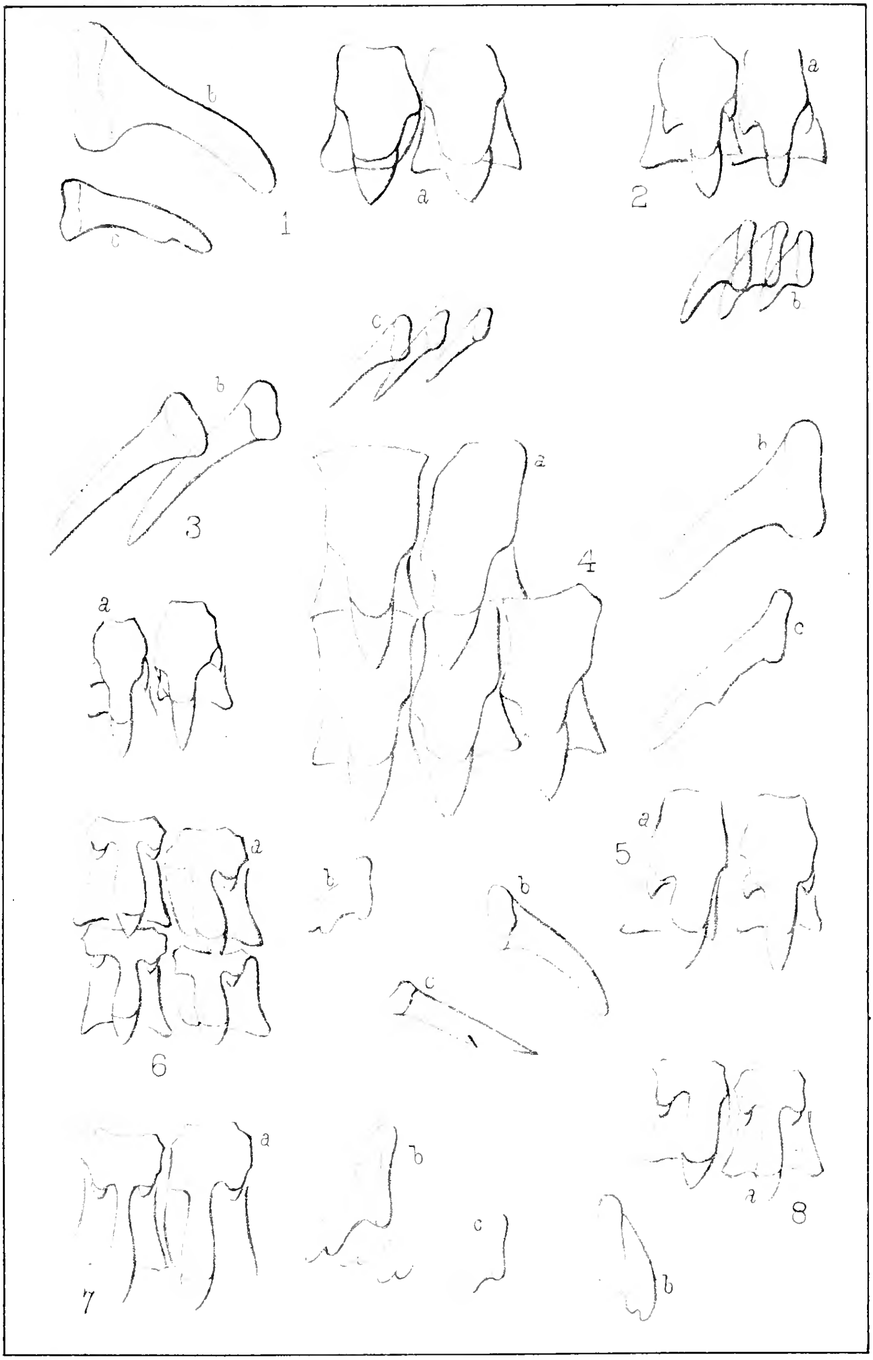
1. 2 Zonites laevigatus. *Pfr*
3 Z. cellarius. *Mull.*
4. Z. friabilis, *W. G. B.*
5. Z. inornatus. *Say*
6 Z. capnodes, *W. G. B.*
7 Z. fuliginosus *Grif.*



W. G. B. del.

T. Sinclair & Son Lith. Phila.

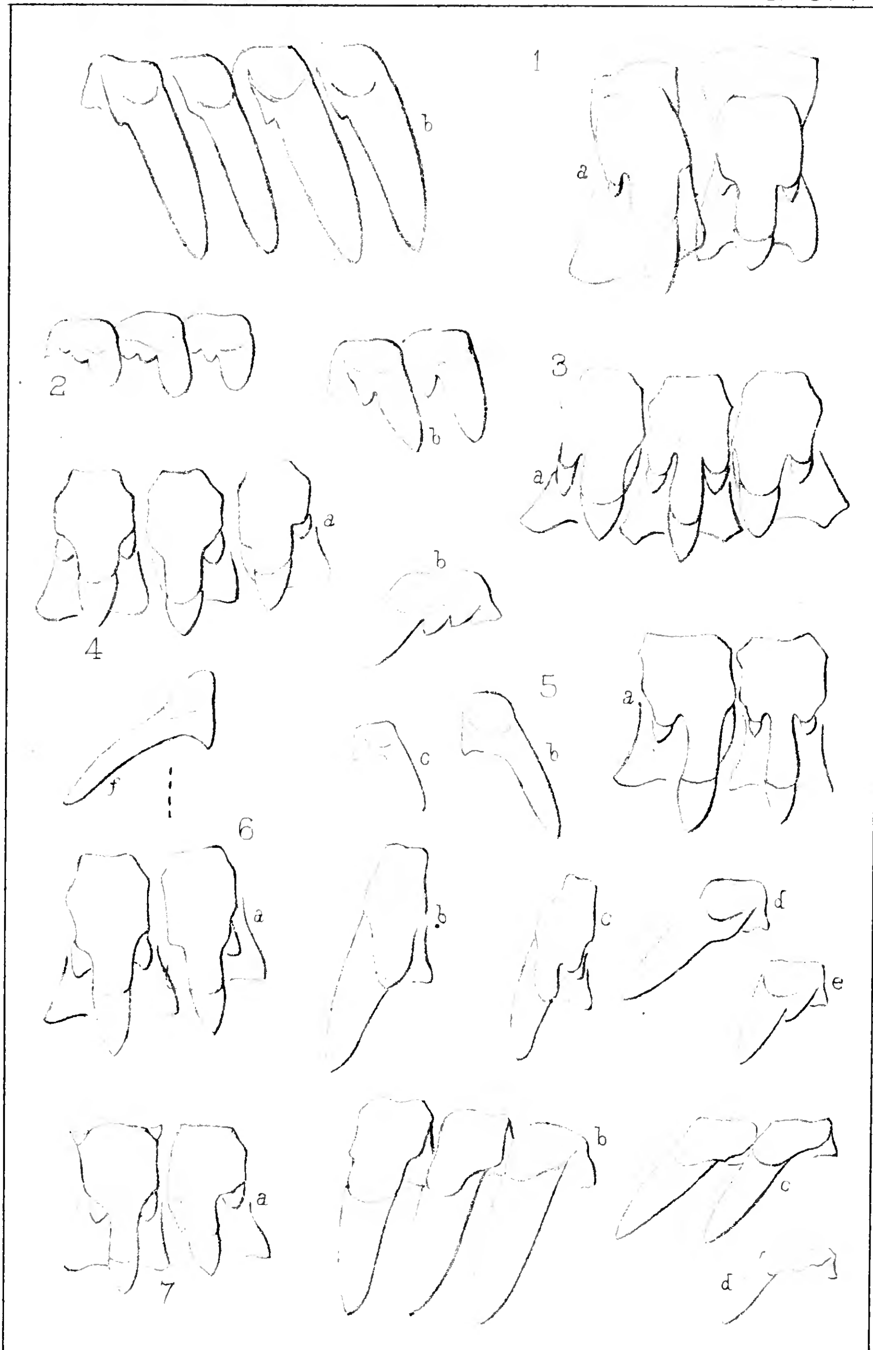
1. Z. gularis, S.
2. Z. sculptilis, Bl.
3. Z. lineatulus, Ward.
4. Z. capsella, Gld.
5. Z. Elliottii, Red.
6. Z. demissus, B.
7. Z. lasmodon, F.
8. Z. intertextus, S.
9. Z. internus, S.
10. Z. Gundlachi, Pfr.
11. Z. ligerus, S.
12. Z. capnodes, W.G.B.



W. G. B. del.

J. H. Bufford's Sons Lith. Boston

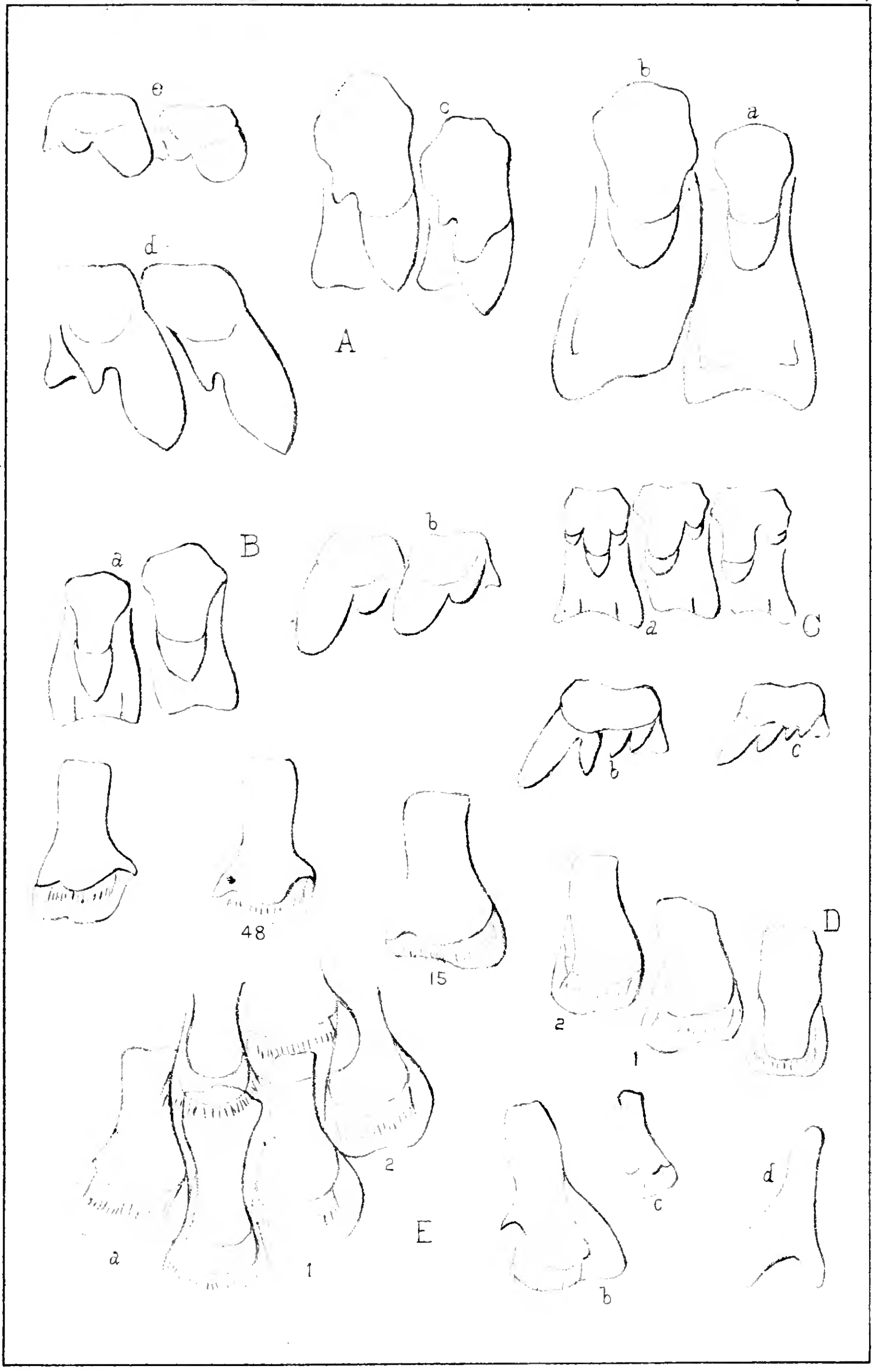
1. Limax flavus. *Lin.*
2. L. Hewstoni. *J. G. C.*
3. L. agrestis. *Lin.*
4. L. maximus. *Lin.*
5. L. campestris. *Binn.*
6. Vitrina Pfeifferi. *New.*
7. V. exilis. *Mor.*
8. V. limpida. *Gld.*



W.G.B. del.

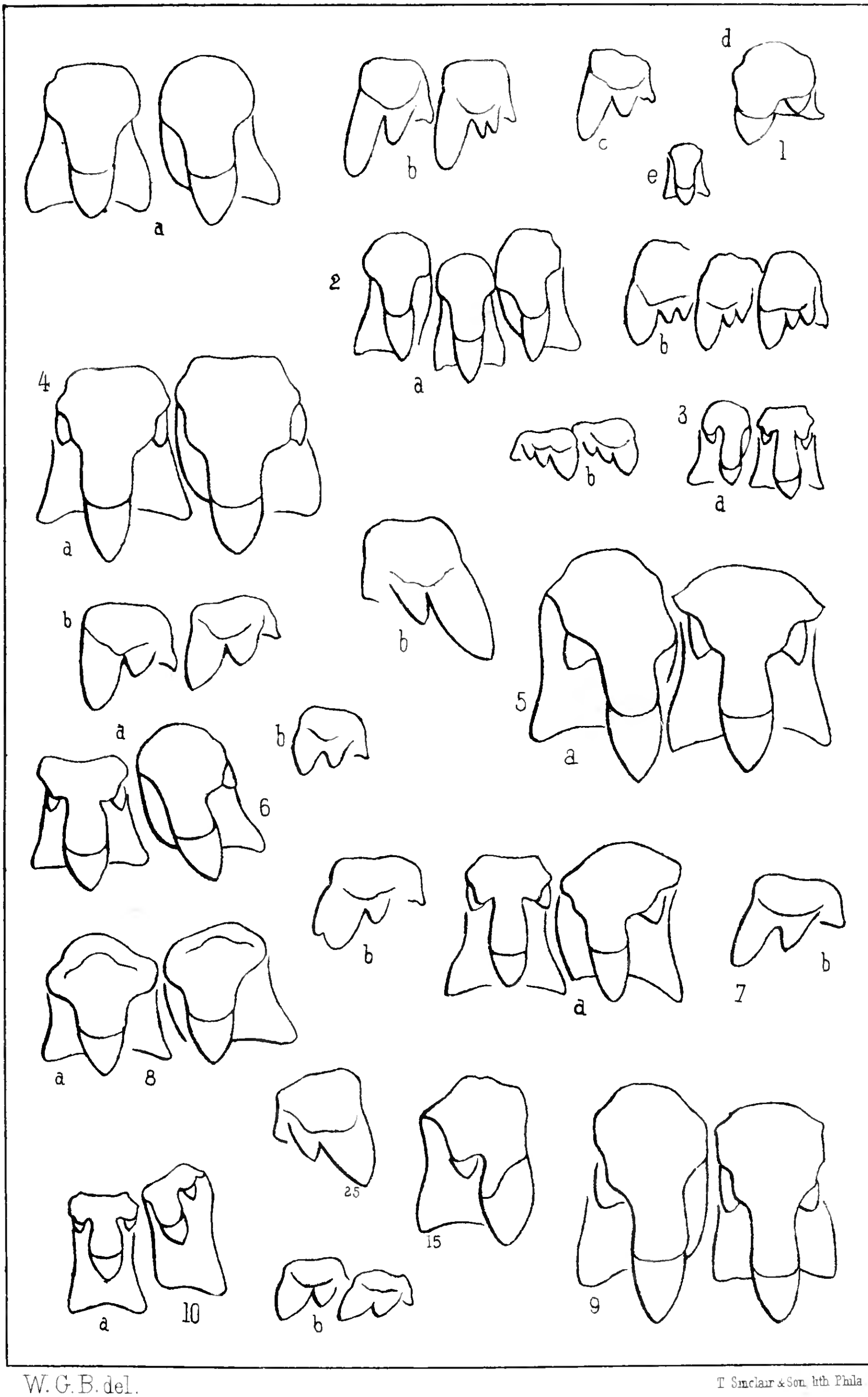
J.H. Bufford's Sons Lith. Boston.

1 Ariolimax Californicus, *J.G.Coop.* 5. Arion hortensis, *Fér.*
2,3. A. niger, *J.G.Coop.* 6 Ariolimax Columbianus, *Gld.*
4 Prophysaon Hemphilli, *Bl. & Binn.* 7 Hemphillia glandulosa, *Bl. & Binn.*



W.G.B. del. J.H. Bufford's Sons Lith Boston.

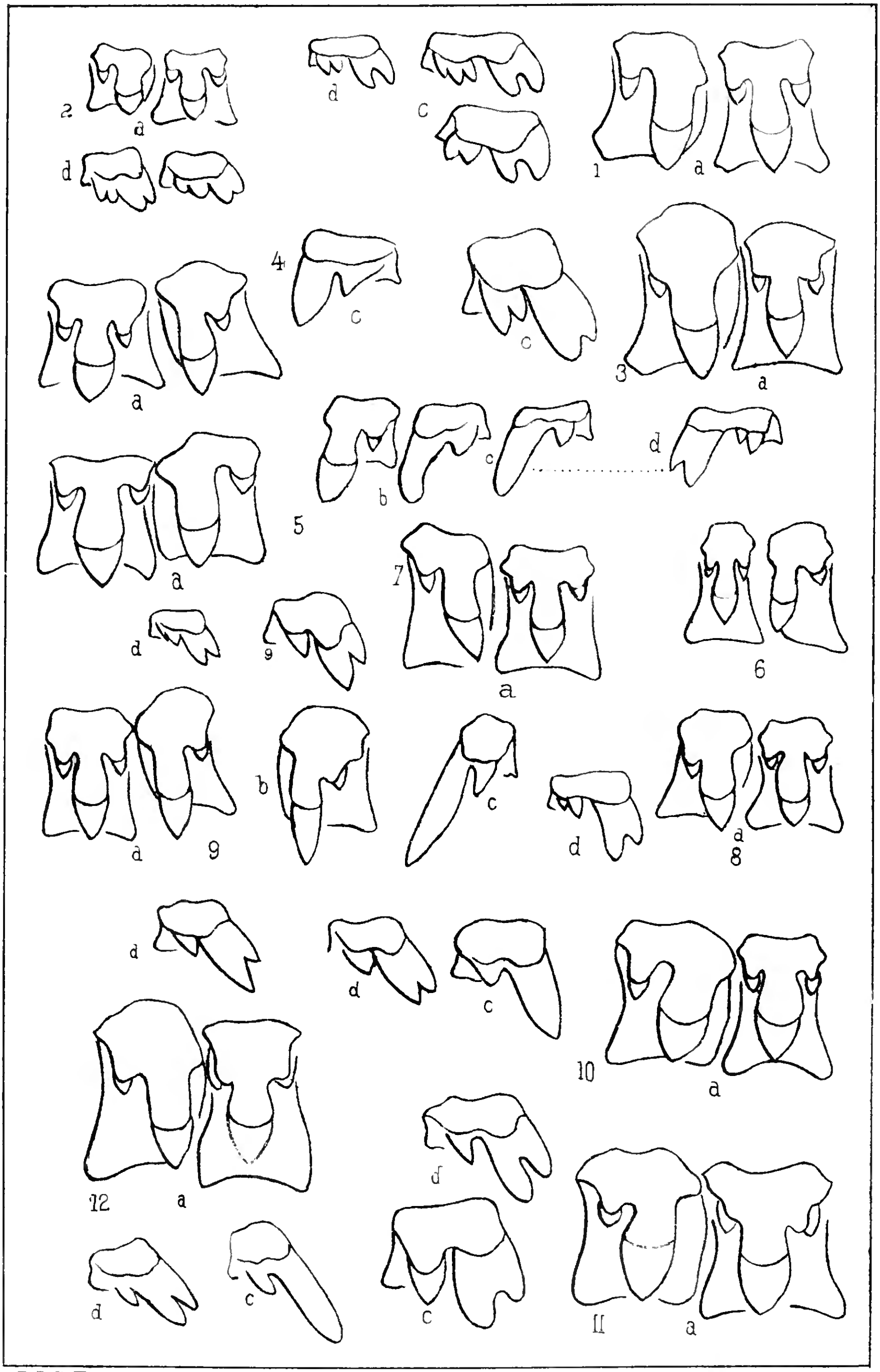
A Tebennophorus Caroliniensis. *Bosc.* C. Pallifera dorsalis *Bin.*
B Pallifera Wetherbyi. *W.G.B.* D Orthalicus undatus. *Brug.*
E Liguus fasciatus. *Mull.*



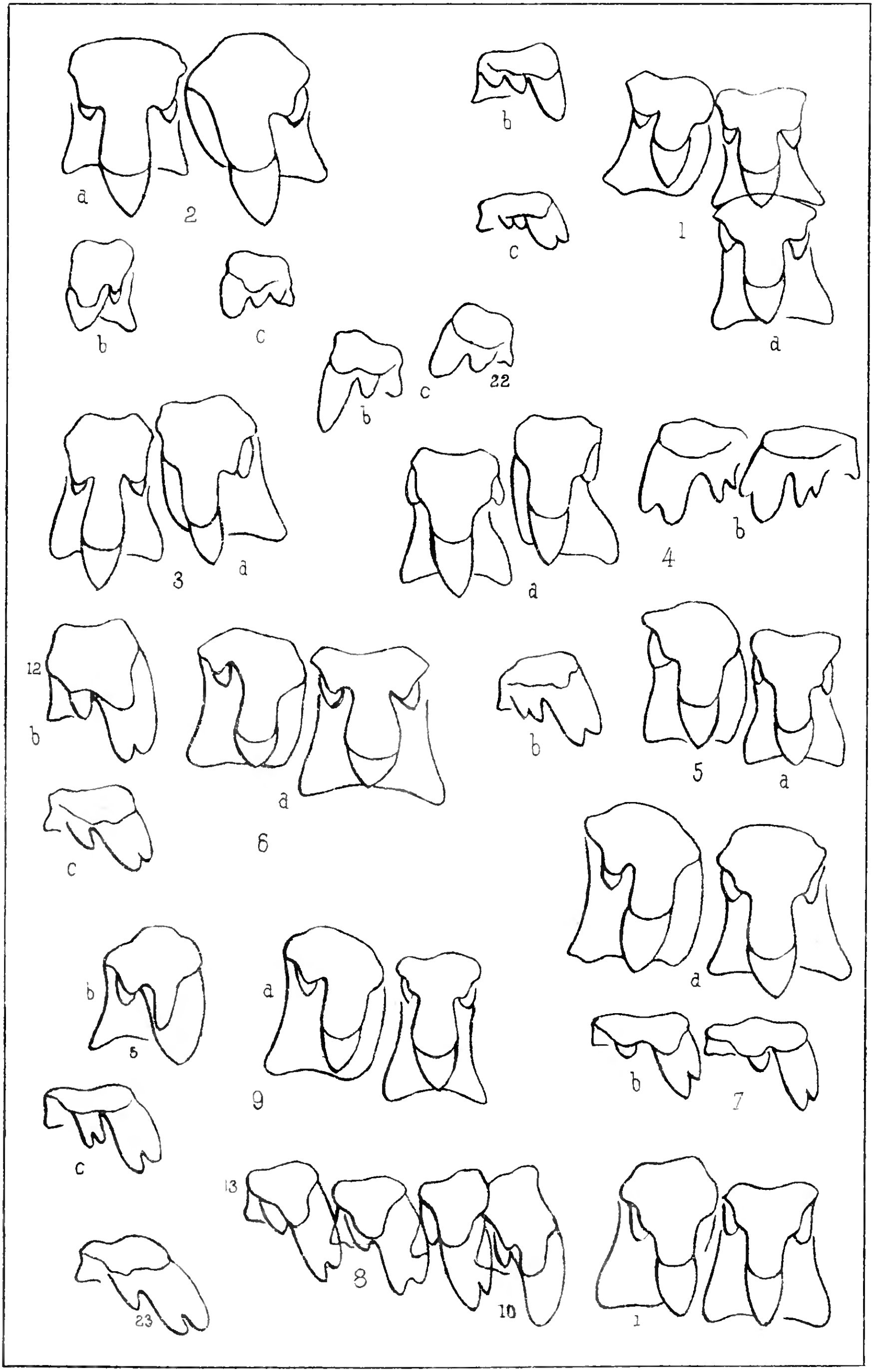
W. G. B. del.

T. Sinclair & Son, lith. Phila.

1. Patula strigosa, *Gld.* 4. Patula Idahoensis, *Newc.* 8. Patula Cumberlandiana, *Lea.*
2. Patula Cooperi, *W.G.B.* 5. Patula alternata, *Say.* 9. Patula solitaria, *Say.*
3. Patula perspectiva, *Say.* 6. Patula Hemphilli, *Newc.* 10. Patula striatella, *Anth.*
7. Patula mordax, *Shuttl.*

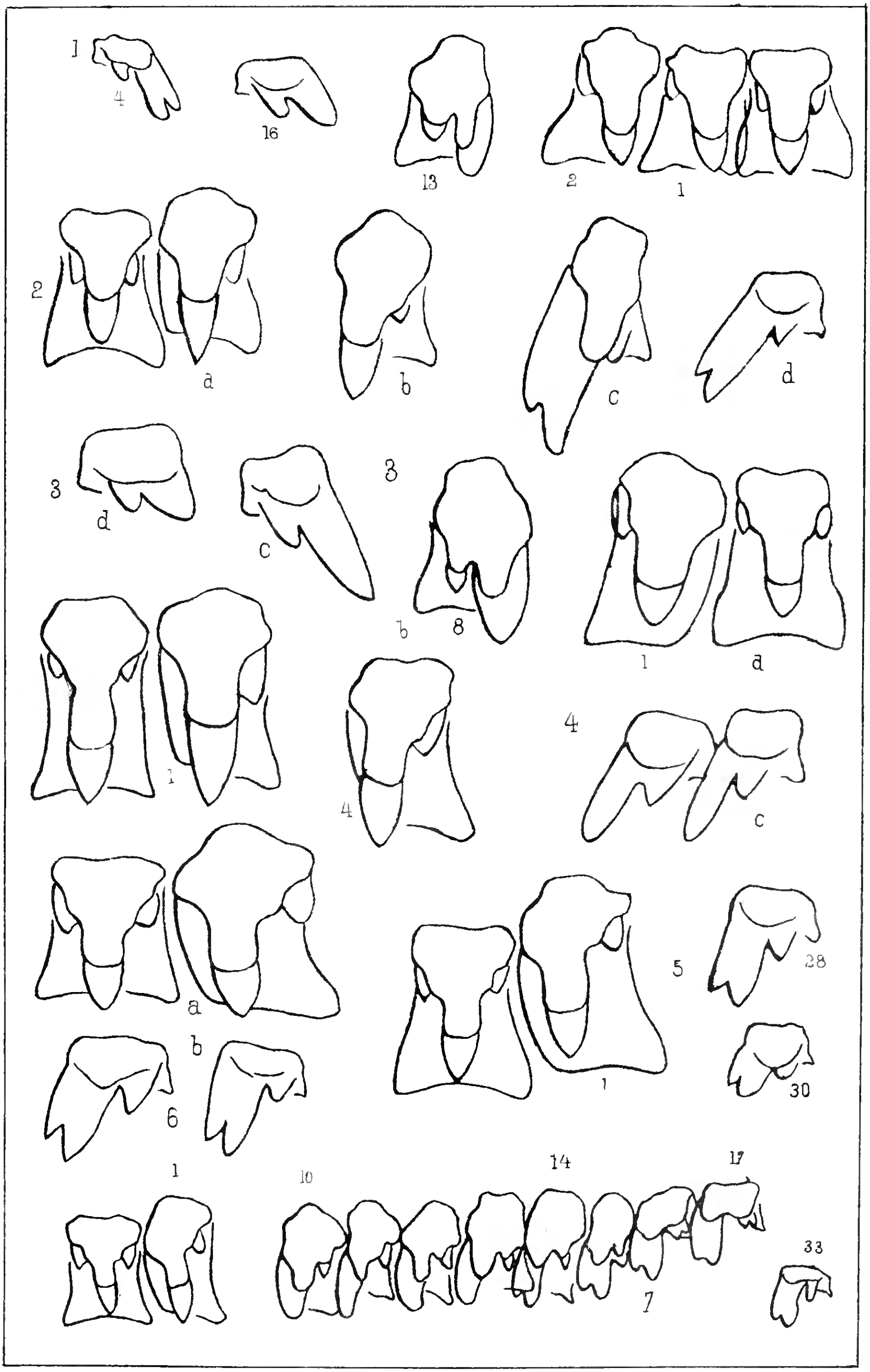


1. Helix Texasiana, *Mor.*
2. Helix Troostiana, *Lea.*
3. Helix uvulifera, *Shuttl.*
4. Helix espiloca, *Rav.*
5. Helix Hazardi, *Bl.*
6. Helix Septemvolva, *Say.*
7. Helix Febigeri, *Bl.*
8. Helix pustula, *Fér.*
9. Helix auriformis, *Bl.*
10. Helix Mooreana, *W. G. B.*
11. Helix fastigans, *Say.*
12. Helix auriculata, *Say.*



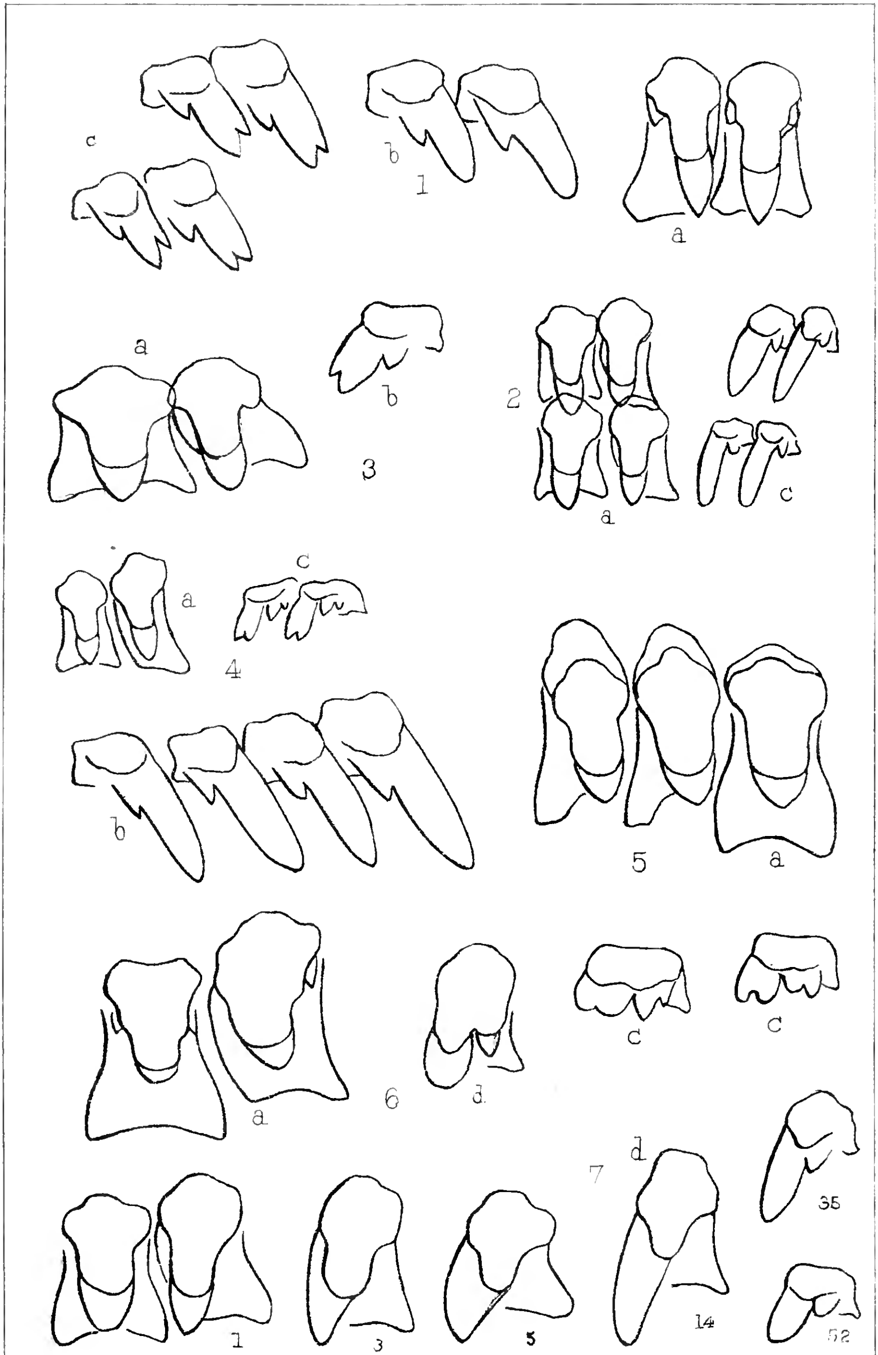
W. G. B. del. T. Sinclair & Son, lith. Phila.

1. Helix Edvardsi, *Bland.* 4. Helix monodon, *Rack.* 7. Helix stenotrema, *Fér.*
2. Helix polygyrella, *Bland.* 5. Helix germana, *Gld.* 8. Helix spinosa, *Lea.*
3. Helix Yatesi, *J. G. Coop.* 6. Helix hirsuta, *Say.* 9. Helix barbigera, *Redf.*



W. G. B. del. T. Sinclair & Son lith Phila

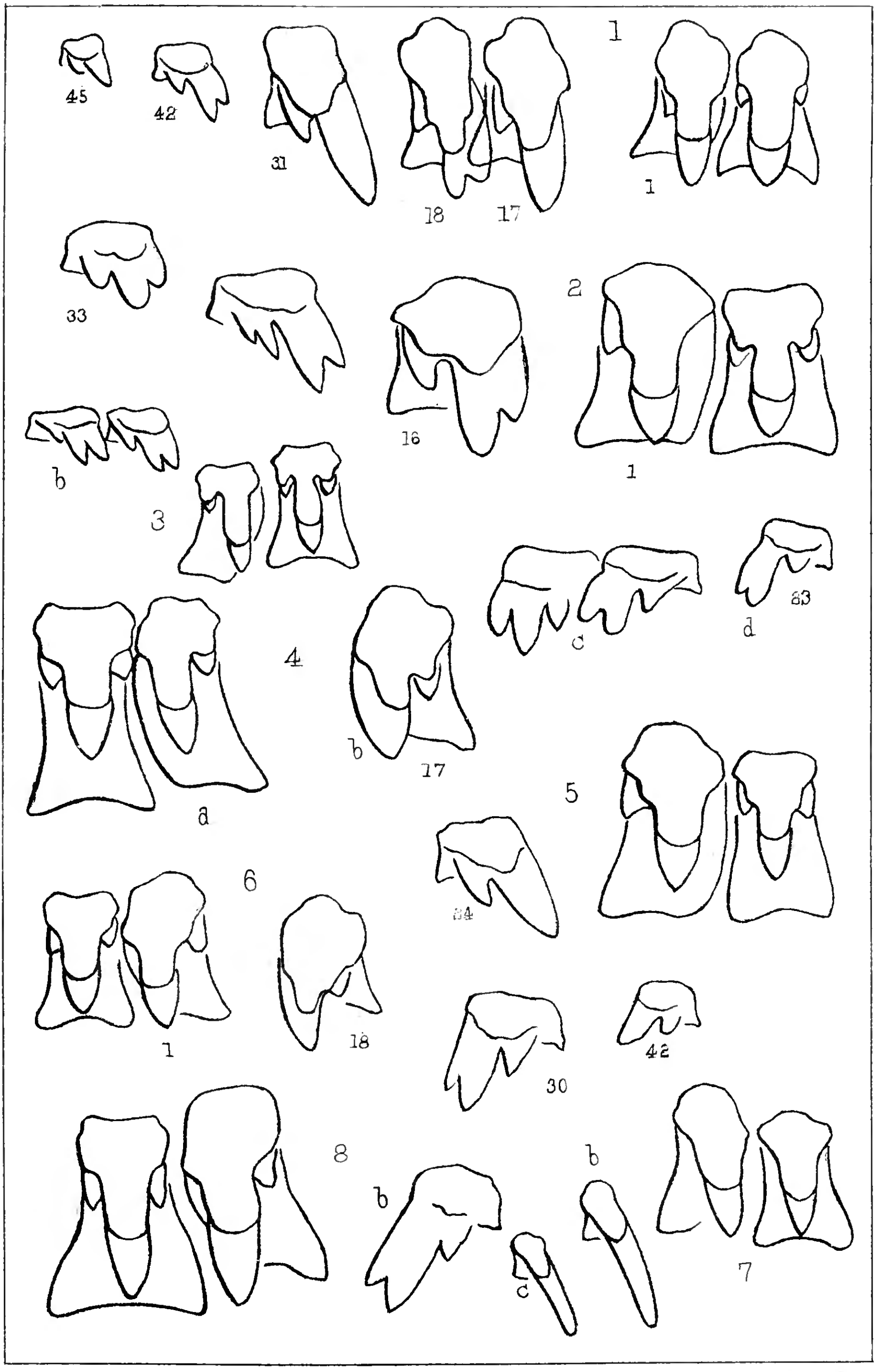
1. Helix tridentata, *Say.* 3. Helix Rugeli, *Shuttl.* 6. Helix Hopetonensis, *Shuttl.*
2. Helix palliata, *Say.* 4. Helix inflecta, *Say.* 7. Helix appressa, *Say.*
5. Helix fallax, *Say.*



W. G. B. del.

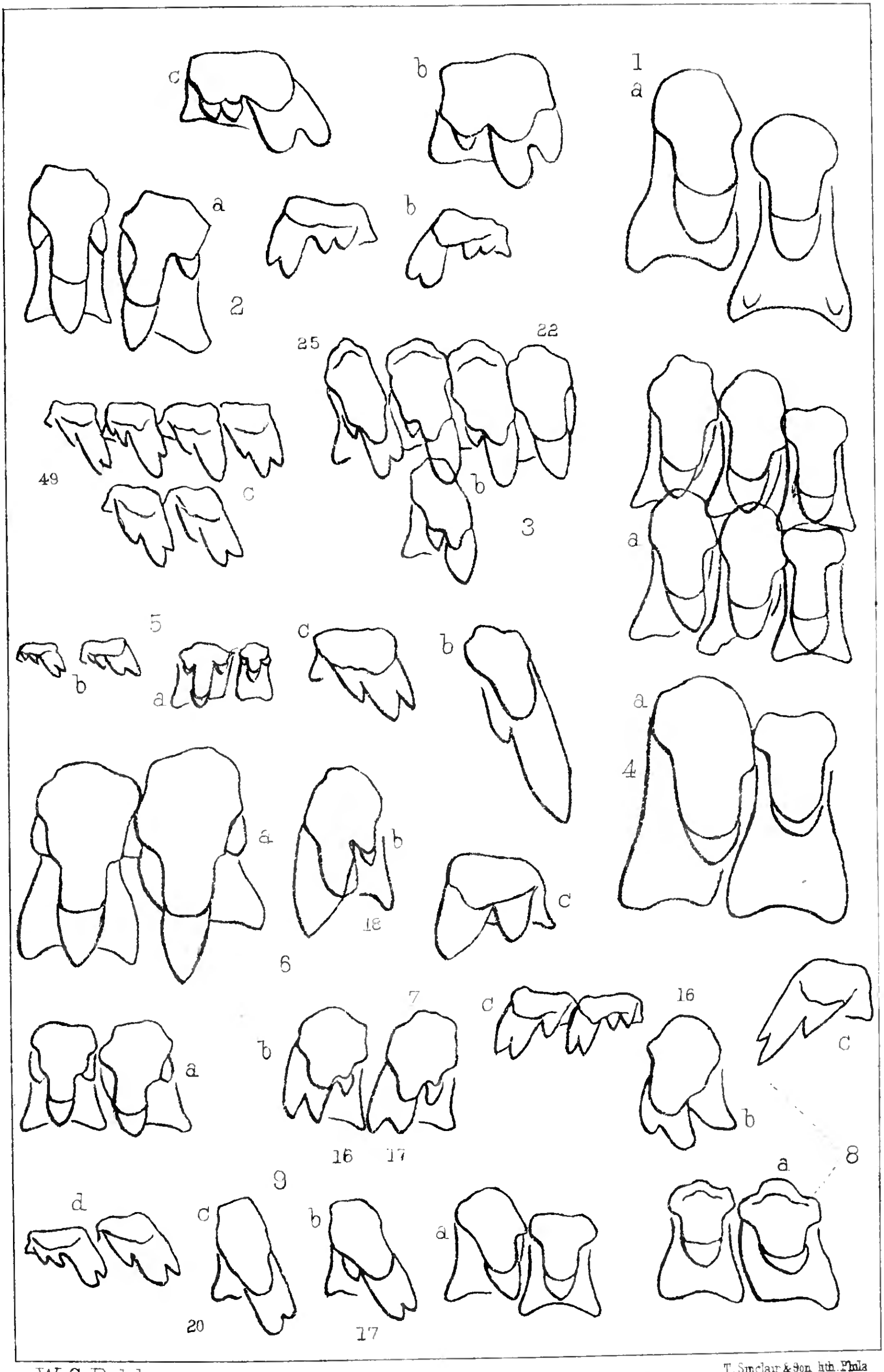
T. Sinclair & Son lith. Phila.

1. Helix albolabris, *Say* 3. Helix Roemeri, *Pfr.* 6. Helix Clarki, *Lea.*
2. Helix Wetherbyi, *Bland* 4. Helix Downieana, *Bl.* 7. Helix exoleta, *Binn.*
5. Helix Sayii, *Binn.*



W. G. B. del. T. Sinclair & Son lith. Phila.

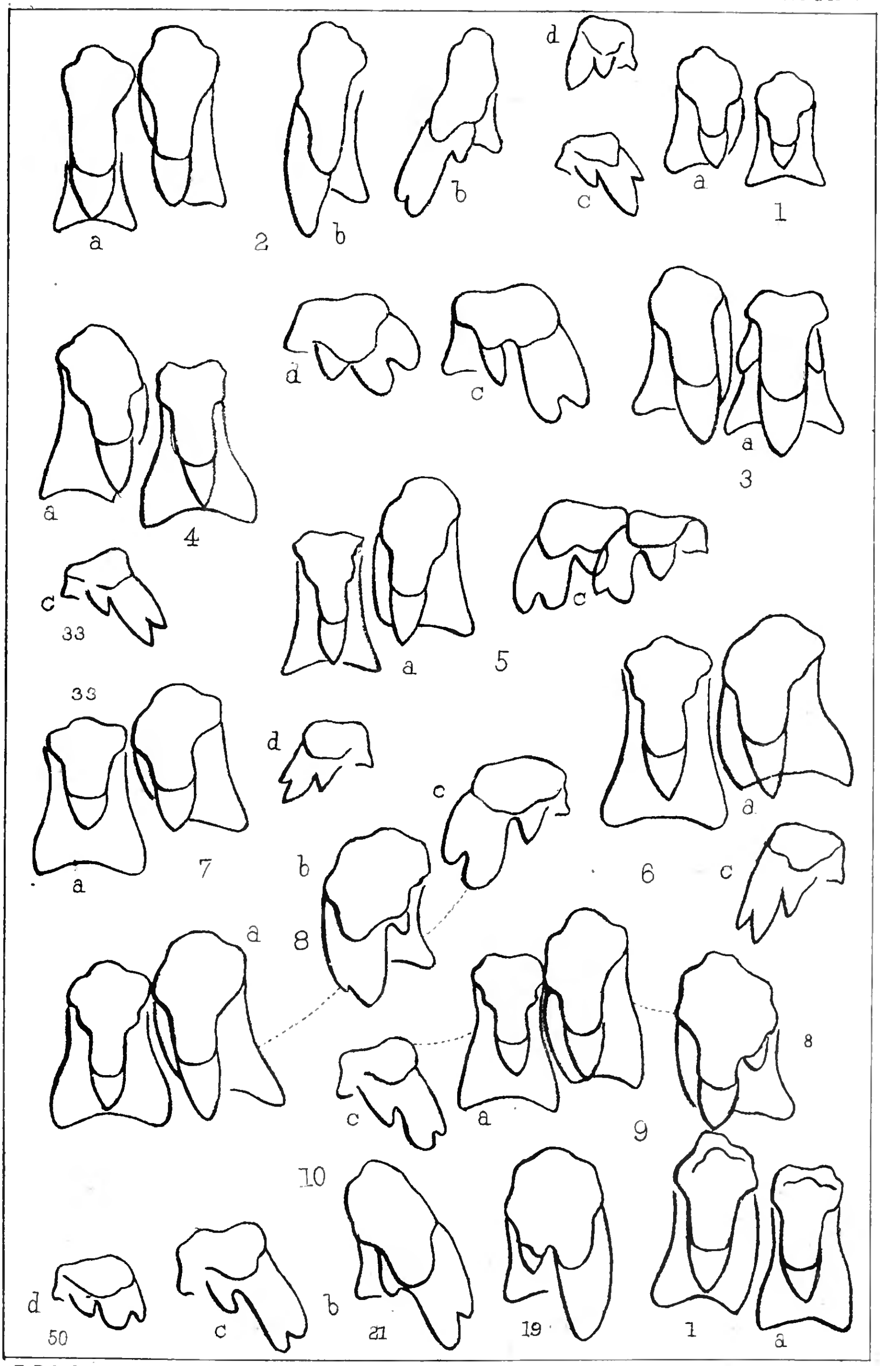
1. Helix elevata, *Say*.
2. Helix Columbiana, *Lea*.
3. Helix Mobiliana, *Lea*.
4. Helix devia, *Gld*.
5. Helix profunda, *Say*.
6. Helix multilineata, *Say*.
7. Helix clausa, *Say*.
8. Helix dentifera, *Binn*.



W. G. B. del.

T. Sinclair & Son lith. Phila.

1. Hemitrochus varians, *Mke.*
2. Helix griseola, *Pfr.*
3. Helix Stearnsiana, *Gabb.*
4. Helix Kelletti, *Forb.*
5. Helix lineata, *Say.*
6. Helix Newberryana, *W. G. Binn.*
7. Helix aspersa, *Müll.*
8. Helix fidelis, *Gray.*
9. Helix infumata, *Gld.*



W. G. B. del. T. Sinclair & Son, lith. Phila.

1. Helix tudiculata, *Binn.*
2. Helix arrosa, *Binn.*
3. Helix ruficinta *New.*
4. Helix Traski, *Newc.*
5. Helix sequoicola, *J. G. Coop.*
6. Helix Ayresiana, *New.*
7. Helix redimita
8. Helix Nickliniana, *Lea.*
9. Helix ramentosa, *Gld.*
10. Helix exarata, *Pfr.*

Zonites capnodes, W. G. B.
fuliginosus, Griff.
friabilis, W. G. B.
caducus, Pfr.
lævigatus, Pfr.
demissus, Binn.
ligerus, Say.
intertextus, Binn.
†**subplanus**, Binn.
inornatus, Say.
sculptilis, Bland.
Elliotti, Redf.
†**cerinoideus**, Anth.
cellarius, Müll.
†**Whitneyi**, Newc.
nitidus, Müll.
arboreus, Say.
viridulus, Mke.
indentatus, Say.
limatulus, Ward.
minusculus, Binn.
milium, Morse.
Binneyanus, Morse.
ferreus, Morse.
†**conspectus**, Bland.

Zonites exiguus, Stimpson.
†**chersinellus**, Dall.
capsella, Gld.
fulvus, Drap.
†**Fabricii**, Beck.
Gundlachi, Pfr.
†**Stearnsi**, Bl.

*

gularis, Say.
suppressus, Say.
lasmodon, Phillips.
significans, Bland.
internus, Say.
multidentatus, Binn.
Lansingi, Bland.
Vitrina limpida, Gould.
†**Angelicæ**, Beck.
Vitrina Pfeifferi, Newc.
exilis, Mor.
Limax maximus, Lin.
flavus, Lin.
agrestis, Mull.
campestris, Binn.
Hewstoni, J. G. Cooper.
Ingersolli, W. G. B.

Helicinæ.

*

Patula solitaria, Say.
strigosa, Gld.
Cooperi, W. G. B.
Hemphilli, Newc.
Idahoensis, Newc.
†**Haydeni**, Gabb.
alternata, Say.
Cumberlandiana, Lea.
†**tenuistriata**, Binn.
perspectiva, Say.
striatella, Anth.
†**pauper**, Mor.
†**Horni**, Gabb
asteriscus, Morse.
†**incrustata**, Pfr.
vortex, Pfr.
Hemitrochus varians, Mke.
Tebennophorus Caroliniensis, Bosc.
†**Holospira Roemeri**, Pfr.

Holospira Goldfussi, Pfr.
Helicodiscus lineatus, Say.
Ferussaccia subcylindrica, L.
Cæcilianella acicula, Müll.
Stenogyra decollata, Linn.
subula, Pfr.
†**octonoides**, Ad.
†**gracillima**, Pfr.
Pupa muscorum, Linn.
†**Blandi**, Morse.
†**Hoppii**, Müll.
†**variolosa**, Gld.
pentodon, Say.
†**decora**, Gld.
†**corpulenta**, Morse.
†**Rowelli**, Newc.
†**Californica**, Rowell.
fallax, Say.
†**modica**, Gld.

†Pupa Arizonensis, Gabb.
†hordeacea, Gabb.
†armifera, Say.
†contracta, Say.
rupicola, Say.
corticaria, Say.
†pellucida, Pfr.
†borealis, Mor.

Arion fuscus, Müll.
†foliolatus, Gld.
Ariolimax Columbianaus, Gld.
Californicus, J. G. Cooper.
Hemphilli, W. G. B.
niger, J. G. Cooper.
Andersoni, J. G. Cooper.
Prophysaon Hemphilli, Bl. and Binn.
Binneia notabilis, J. G. Cooper.
Hemphillia glandulosa, Bl. and Binn.
Pallifera dorsalis, Binn.
Wetherbyi, W. G. B.
Gonostoma Yatesi, J. G. Cooper.
Strobila labyrinthica, Say.
Hubbardi, Brown.
Polygyra auriculata, Say.
uvulifera, Shuttl.
auriformis, Bld.
†Postelliana, Bld.
espiloca, Rav.
†avara, Say.
ventrosula, Pfr.
†Hindsi, Pfr.
Texasiana, Moricand.
†triodonto des, Bld.
Mooreana, W. G. Binn.
†tholus, W. G. Binn.
†hippocrepis, Pfr.
fastigans, L. W. Say.
†Jacksoni, Bld.
Troostiana, Lea.
Hazardi, Bld.
†oppilata, Moricand.
†Dorfeuilliana, Lea.
†Ariadnæ, Pfr
septemvolva, Say.
cereolus, Muhlf.
†Carpenteriana, Bld.
Febigeri, Bld.

Vertigo Gouldi, Binn.
Bollesiana, Morse.
†milium, Gld.
ovata, Say.[1]
ventricosa, Morse.
†simplex, Gld.
Strophia incana, Binn.

*

Polygyra pustula, Fér.
†pustuloides, Bld.
leporina, Gld.
Polygyrella polygyrella, Bld. and J. G Cooper.
Stenotrema spinosa, Lea.
†labrosa, Bld.
†Edgariana, Lea.
Edvardsi, Bld.
barbigera, Redf.
stenotrema, Fér.
hirsuta, Say.
†maxillata, Gld.
monodon, Rack.
germana, Gld.
Triodopsis palliata, Say.
obstricta, Say.
appressa, Say.
inflecta, Say.
Rugeli, Shuttl.
tridentata, Say.
Harfordiana, J. G. Cooper.
fallax, Say.
†introferens, Bld.
Hopetonensis, Shuttl.
†vultuosa, Gld.
loricata, Gld.
Mesodon major, Binn.
albolabris, Say.
†divesta, Gld.
multilineata, Say.
Pennsylvanica, Green.
Mitchelliana, Lea.
elevata, Say.
Clarki, Lea.
†Christyi, Bld.
exoleta, Binn.
Wheatleyi, Bld.

[1] *V. tridentata*, Wolf, is synonymous with this.

Mesodon dentifera, Binn.
Roëmeri, Pfr.
Wetherbyi, Bland.
thyroides, Say.
clausa, Say.
Columbiana, Lea.
Downieana, Bld.
†Lawi, Lewis.
†jejuna, Say.
Mobiliana, Lea.
devia, Gld.[1]
profunda, Say.
Sayii, Binn.
Acanthinula harpa, Say.
Vallonia pulchella, Mull.
Fruticicola hispida, L.
†rufescens, Penn.
Dorcasia Berlandieriana, Mor.
griseola, Pfr.
Aglaja fidelis, Gray.
infumata, Gld.
†Hillebrandi, Newc.
Arionta arrosa, Gld.
Townsendiana, Lea.[2]
Arionta tudiculata, Binn.
Nickliniana, Lea.
Ayresiana, Newc.
redimita, W. G. Binn.
†intercisa, W. G. Binn.
Kelletti, Fbs.
Stearnsiana, Gabb.
exarata, Pfr.
ramentosa, Gld.
†Californiensis, Lea.
Carpenteri, Newc.
†Mormonum, Pfr.
sequoicola, J. G. Cooper.
Diabloensis, J. G. Cooper.
Traski, Newc.
†Dupetithouarsi, Desh.
ruficincta, Newc.
facta, Newc.
†Gabbi, Newc.
Glyptostoma Newberryana, W. G. Binn.
Euparypha Tryoni, Newc.
Tachea hortensis, Müll.
Pomatia aspersa, Müll.

*

Cylindrella Poeyana, Pfr.
†jejuna, Gld.
†Macroceramus Kieneri, Pfr.
Gossei, Pfr.
†Bulimulus multilineatus, Say.
†Dormani, W. G. B.
†Bulimulus Marielinus, Pfr.
†Floridanus, Pfr.
†patriarcha, W. G. B.
alternatus, Say.
†Schiedeanus, Pfr.
dealbatus, Say.

ORTHALICINÆ.

Liguus fasciatus, Mull.
Orthalicus zebra, Mull.
Orthalicus undatus, Brug.
Punctum minutissimum, Lea.

SUCCININÆ.

†Succinea Haydeni, W. G. B.
†retusa, Lea.
Sillimani, Bld.
ovalis, Gld. not Say.
†Higginsi, Bld.
†Haleana, Lea.
†Mooresiana, Lea.
†Grosvenori, Lea.
†Wilsoni, Lea.
†Concordialis, Gld.
†Succinea luteola, Gld.
lineata, W. G. Binn.
avara, Say.
Stretchiana, Bld.
†Verilli, Bld.
†aurea, Lea
†Groënlandica, Beck.
obliqua, Say.
Totteniana, Lea.
campestris, Say.

[1] *H. Mullani* is a variety of this.
[2] *H. ptychoptora*, Brown, is a variety of this.

†**Succinea Hawkinsi**, Bld.
†**rusticana**, Gld.
Nuttalliana, Lea.
†**Succinea Oregonensis**, Lea.
effusa, Shuttl.
†**Salleana**, Pfr.

VERONICELLIDÆ.

Veronicella Floridana, Binn.
†**Veronicella olivacea**, Stearns.

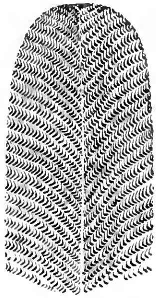
A. *Jaw absent.*

Family OLEACINIDÆ.

Genus GLANDINA, Schum.

Lingual membrane narrow, with chevron-shaped rows of uniform, aculeate, separated teeth; central tooth with a long, slender,

Fig. 1.



Lingual membrane of *G. truncata.*

Fig. 2.

Lingual dentition of *Glandina truncata.*

straight base of attachment, with incurved sides, and with inferior lateral slightly expanded angles, and with the upper margin reflected and extended into a long, slender, acutely pointed cusp. There are no lateral teeth, the balance of the membrane being composed of marginal teeth of the pure aculeate form.

Each row of teeth on either side of the median line curves first backward, with the teeth rapidly increasing in size as they pass outwards, and then forwards as the teeth gradually again become smaller; giving an irregularly crescentic shape to the half row of teeth. This is shown particularly in *Gl. Albersi* and *G. rosea*, less so in *Gl. truncata.* The central tooth was overlooked by Wyman, Leidy, and other of the earlier investigators. It has since been detected in *Gl. truncata*,[1] *rosea*,[2] *algira*,[3] *Sowerbyana*,[4] *plicatula*,[5] *fusiformis*,[6] *Albersi*;[7] in *semitarum*,[8] *Phillipsi*[9] of the subgenus *Varicella*; also *solidula*[10] of subgenus *Oleacina*. This central tooth is rather difficult to study, being on a different plane than the other teeth, and apparently much less developed. Its cusp is generally simple, long, and narrow; but in *G. rosea* it has a decided blunt cutting point, and in *G. semitarum* it has a long, slender, cutting point.

The side teeth are all of the purely aculeate type; the base of attachment is long, narrow, incurved at sides, gradually rounded above, expanded and bluntly truncated below, the general outline being somewhat like that of the sole of a shoe. From this base of attachment springs a large aculeate cusp. These side teeth are like the marginals in *Zonites*, *Limax*, etc.; they may therefore be called marginal teeth, and the lateral teeth, usually present in the *Vitrininæ*, may be said to be entirely wanting.

As stated above, the marginal teeth increase rapidly in size for a short distance from the median line, and then gradually decrease in size, as they pass off laterally, the last tooth being still smaller than the first.

Glandina truncata has 32—1—32 teeth in each row. I have shown in plate I., fig. 1*a*, the central and first three marginals; *b* is the twentieth marginal; *c*, the last tooth. Fig. *a* and *c* show the teeth as seen from below, thus giving a perfect view of the bases of attachment. Fig. *b* is a strictly profile view. The eighth tooth seems to be the largest. The central tooth I find great difficulty in studying. It appears to have a simple, long, slender base of attachment, truncated above and below with slightly expanded lateral angles. The sides are somewhat incurved, giving the tooth the appearance of a simple modification of the base of attachment of the marginals. The figure (2) by Morse, copied

[1] See L. and Frw. Shells, I., fig. 6.

[2] Amer. Journ. Conch., V. 202, fig. 1.

[3] Fischer and Crosse, J. de C. XVI. 234, 1868; Moll. Mex. et Guat., pl. IV. fig. 10.

[4] Same, Moll. Mex. et Guat. 73, pl. IV. figs. 6–9.

[5] Same, p. 73.

[6] Same, p. 73.

[7] L. and Frw. Shells, I., fig. 10, p. 19.

[8] Proc. A. N. S. Phil. 1874, 49.

[9] Same.

[10] Ann. Lyc. N. H. of N. Y., X. 347.

above, gives a better illustration of this central tooth than is shown in my plate. I have lately verified it in fine specimens collected by myself in Florida.

In illustrating the dentition of this genus, I have given fig. 1, copied from Dr. Leidy's figure in Terr. Moll. U. S., to show the general arrangement *en chevron* of the rows of teeth. Fig. 2 by Morse, copied from L. and Frw. Sh. N. A., I., gives one-half of one transverse row of teeth, with the central tooth. Fig. 1 of my plate is intended to show the shape of the individual teeth: *a* gives the central with adjacent marginals; *b*, the twentieth marginal in profile; *c*, the thirty-second and last marginal.

I have not had an opportunity of examining the lingual membrane of *G. bullata*, *Texasiana*, *decussata*, or *Vanuxemensis*.

B. *Jaw present.*

Family HELICIDÆ.

This family may be divided by the character of its jaw in connection with that of its dentition into several subfamilies, *Vitrininæ*, *Helicinæ*, *Orthalicinæ*, *Succininæ*. The characteristic of each will be given below.

a. Jaw in one single piece; marginal teeth aculeate. VITRININÆ.

Genus **MACROCYCLIS**, Beck.

Jaw crescentic, ends sharply pointed, anterior surface striated; cutting margin smooth, with a median projection. I have examined the jaw of *M. Vancouverensis* (see fig. 3, copied from L. and Frw. Sh., I.), *concava*, *Duranti*, *Voyana*, and in the West Indian species, *M. Baudoni*,[1] Petit, and *M. euspira*, Pfr.

Fig. 3.

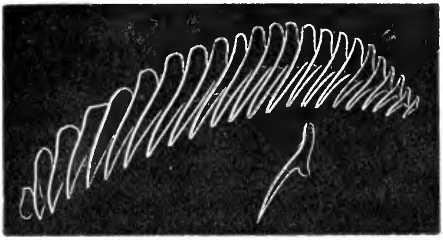
Jaw of *Macrocyclis Vancouverensis*.

The general arrangement of the lingual membrane of *Macrocyclis* is the same as I have described above for *Glandina*.

There are 32 rows in one lingual examined of *M. Vancouverensis*. The rows of teeth are arranged *en chevron*. Each row is

[1] See Am. Journ. Conch. VII. 175; Ann. Nat. Hist. N. Y., X. 305.

Fig. 4.



Lingual dentition of *Macrocyclis Vancouverensis.*

divided by the median line into two irregular crescents, the teeth rapidly increasing and curving in a backward direction, and then gradually decreasing in size and curving forward. In *M. Vancouverensis* the sixth tooth is the largest. One of these subcrescentic rows is shown in fig. 4, copied from L. and Frw. Sh., I., drawn by Morse. This figure, however, must not be used to judge of the shape of the separate teeth, better shown in plate I. The teeth of *Macrocyclis*, as also of *Glandina*, are separated, not crowded, as in the *Helicinæ*. The central tooth is seen with some difficulty by the microscope. I am confident, however, that I have drawn it correctly for the various species. In *M. Vancouverensis* (pl. I., fig. 4), the base of attachment is small, triangular, the apex pointed backward, the angles bluntly rounded, somewhat incurved at base, and bears a delicate, simple, short, slender cutting point, reaching from about its centre to near its base. This cutting point was not figured by Morse (see above fig.), and, indeed, was observed by me only on a few of the central teeth, and then with difficulty. In *M. concava* (pl. I., fig. 3) the central tooth has a larger base of attachment, the apex of the triangle is truncated and incurved, the base is more incurved, the outer lower corners more expanded and pointed, the cutting point more developed, with distinct lateral expansions like very slightly developed subobsolete side cusps. In *M. Voyana* (pl. I., fig. 5), the central tooth has a long, narrow, quadrangular base of attachment, incurved above, below, and at sides, and bears near its base three small, sharp cutting points, the median the largest; there seems to be no distinctly developed cusps bearing these cutting points. In *M. Duranti* the central tooth has a base of attachment somewhat like that of *M. Vancouverensis*, but longer, and with incurving sides; the cutting point is the same. I have not examined the lingual membrane of *M. sportella*, which may be merely a variety of *Vancouverensis*. The other species mentioned above are readily distinguished one from another by the form of their central teeth.

I may here mention that Tryon (Am. Jour. Conch., II. 246) erroneously includes in *Macrocyclis* a true species of *Zonites*, *Z. Elliotti*, characterized by caudal mucous pore, parallel longitudinal furrows above the margin of the foot, and the presence of perfect lateral teeth.

The side teeth of *Macrocyclis* at first sight, especially when seen from below, appear to be of the purely aculeate type, as the marginals in *Zonites* and *Limax*. From this, one is inclined to consider them all as marginals, and to declare that no true lateral teeth exist, thus making *Macrocyclis* to agree with *Glandina* in this particular also. A more careful study shows us that the teeth nearest the median line are modified from the aculeate type, though they do not have the distinct form of the laterals of *Zonites*, with decided cusps and cutting points. They seem rather to represent those teeth of *Zonites* which show the transition from the laterals to the marginals (see pl. II., fig. 2, the second lateral tooth of *Z. lævigatus*). It may be said, therefore, that the lateral teeth are entirely wanting in *Macrocyclis*, the first side teeth being laterals in the transition state, the balance being pure marginals. (See, however, *M. euspira*, below, which has a lingual membrane of *Glandina*.) The base of attachment of these transition teeth is like those of the marginals, i. e., sole-like, except that the lower lateral expansions are more developed and angular, and in *concava* and *Voyana* the lower edge is excurved rather than incurved. The cusps are long and slender, lengthened into cutting points; the teeth are unsymmetrical by the greater development of the outer subobsolete side cusps, both of these cusps being distinctly indicated by expansion. In *M. Vancouverensis* there is apparently a small sharp side point on the inner side of the cusp. I am not certain of its character, and have not ventured to figure it, excepting on the second tooth in fig. 4*a*. This process is seen on the first six teeth only. The balance of the teeth beyond the transition teeth in all the species are marginals of the pure aculeate type. They vary in sharpness in different parts of the same membrane, as will be seen by comparing my figure 4*b* of *M. Vancouverensis* with the marginals in profile given by Morse (see above fig. 2). In *M. Duranti* the extreme marginals are large in comparison with those of the other species.

In studying my figures, it must be remembered that fig. 3*a*, 5*a*, and 4*c* are drawn as seen from above, to show the form of the cusp. The other figures are drawn from below, to show the base of attachment.

M. Vancouverensis, drawn by Morse, has 22—1—22 teeth, two other membranes examined by me gave 24—1—24, one other 18—1—18. *M. concava* has given 20—1—20, 23—1—23, and 25—1—25. Of *M. Duranti* I have counted but one membrane having 18—1—18. A single membrane of *M. Voyana* had 24—1—24 teeth.

To sum up the characters of the dentition of *Macrocyclis* it may be said to be intermediate between *Glandina* and *Zonites*, differing from the former in the presence of the transition teeth from true laterals to true marginals, differing, however, from the latter by the absence of true lateral teeth.

Genus **ZONITES**, Montf.

In the preceding genus *Glandina* we found only the aculeate form of teeth or pure marginals; in *Macrocyclis* we found in addition to these marginals a few showing a modification of this type, being the transition teeth from marginals into laterals. In the present genus, *Zonites*, we find for the first time the lateral teeth in their full development. Thus we have the three forms of teeth, centrals, laterals, and marginals, all present, and apparently a generic characteristic. It will be noticed, however, that in *lævi-*

Fig. 5.

General view of dentition of *Zonites indentatus*.

gatus[1] (pl. II., fig. 1, 2) there is no perfect lateral, the first tooth showing a decided modification or transition into the marginals. Thus we cannot say that in all species of *Zonites* there are pure lateral teeth. It will be seen below that in some species the number of laterals is reduced to two.

[1] See also *cellarius*.

I give in fig. 5 a general view of the arrangement of the teeth in *Zonites*.[1] The centrals have a base of attachment longer than wide, subquadrate, with lateral expansions at the corners of the lower margin. The reflected portion varies in size in the various species, from highly developed in *viridulus* (pl. XVII., fig. 6) and others, to slightly developed in *lasmodon* (pl. III., fig. 7) and others; in the latter case resembling the short reflection of *Vitrina*. The reflection always bears a more or less developed central cusp, generally reaching to or beyond the lower margin of the base of attachment, and always bearing a distinct cutting point, which last, like the cusp, is usually slender, and projects over the tooth of the adjoining transverse line. The side cusps of the reflected portion of the tooth are usually subobsolete, but they are distinctly developed in *Z. lasmodon* (pl. III., fig. 7), *suppressus* (pl. XVII., fig. 11), *Gundlachi* (pl. III., fig. 10), *capsella* (fig. 4), *gularis* (fig. 1), *arboreus* (pl. XVII., fig. 4), *cellarius* (pl. II., fig. 3), *lævigatus* (fig. 1, 2), *significans* (pl. XVII., fig. 10), *ferreus* (pl. XVII., fig. 9), *viridulus* (pl. XVII., fig. 6), *nitidus* (pl. XVII., fig. 7), *fulvus* (pl. XVII., fig. 5), *milium* (pl. XVII., fig. 8). On the side cusps are distinctly developed cutting points in all the species I have examined, excepting *lævigatus* and *cellarius*, in which I find no trace of cutting points. These points when present vary in development in the various species, generally disposed to be triangular and somewhat aculeate in form, thus bearing a resemblance to the cusp of the marginal teeth. The greatest development of these cutting points is seen in *Z. capnodes* (pl. II., fig. 6; pl. III., fig. 12). I have given on pl. III., fig. 12, an enlarged view of a central in *Z. capnodes; a b c d* gives the base of attachment, *e* the reflected portion of the tooth, *f f* the subobsolete side cusps, *h* the median cusp, *i* the cutting point of the median cusp, *g g* the cutting points of the side cusps. The general outline of the central tooth is graceful and slender as compared with the other genera, except *Limax* and *Vitrina*.

The lateral teeth in *Zonites* are of the same type as the central but are rendered unsymmetrical (as usual in the land shells) by, the suppression of the inner, lower, lateral expansion of the base of attachment and the inner side cusp and cutting point. It is

[1] The characters of the separate teeth of this species are better shown in pl. XVII., fig. 3.

only in *Z. Gundlachi* (pl. III., fig. 10) that I have observed the inner side cutting point, and in this species, even, the lateral teeth are still sufficiently unsymmetrical to be readily distinguished from the centrals; in *Z. Binneyanus* there is also a kind of inner cutting point. As mentioned above, the number of these lateral teeth varies in the respective species, and is so nearly constant as to be, I believe, a good specific character. I find, however, some difficulty in deciding in all cases where the true laterals end and the transition teeth commence, so gradual is the change in some species. Of two linguals of *Z. intertextus* examined, I found one to have 12, the other 14, perfect laterals. The number of lateral teeth in the different species is given below.

The teeth forming the gradual change from laterals to marginals are best illustrated in the case of *Z. lævigatus* (pl. II., fig. 2), the first four side teeth being transition teeth. As already stated above, this species wants entirely the perfect laterals. In *Z. cellarius* (pl. II., fig. 3) the two transition teeth have an inner lateral spur near the top of the cusp. The only lateral of this species has also peculiarities in its form easily seen in the figure, but difficult of description.

The marginal teeth of *Zonites* are quite like those of *Glandina* and *Macrocyclis* (see above). The curve of the transverse rows, the rapid increase and gradual decrease in size as they pass off laterally, is shown in pl. II., fig. 1, 3, and in the several wood-cuts I have given. The number of marginal teeth in each species examined is given below; it must be borne in mind, however, that the number is not constant in any given species, though the range of variation in number seems limited in the respective species. Thus, though I have found a slight difference in the count of teeth of *Z. inornatus*, I have every reason to believe I shall never find it to have as many teeth as in *Z. fuliginosus*. It appears, therefore, that the count of teeth has a decided specific value, at least in most cases.

The rapid increase and subsequent gradual decrease in size of the teeth as they pass off laterally, though it appears usually a generic character, is somewhat modified in some species. Thus in one lingual membrane of *Z. intertextus* examined I find a much more gradual and regular decrease from the first to the last marginal tooth.

The marginal teeth in *Zonites*, and, indeed, all the *Vitrininæ*, are more separated than in *Helix*, and the separate rows are more widely removed the one from the other, especially near the outer margin of the membrane.

Though the simple aculeate form of marginals seems a generic character in *Zonites*, we find the marginals bifid in *Z. fulvus* (pl. XVII., fig. 5), and bifid or even trifid in *Z. Gundlachi* (pl. III., fig. 10), also for the first four marginals in *milium*. This character reminds us of *Vitrina* (see below); *Vitrinoconus* (Semper, Phil. Archip., 91); *Vitrinoidea* (Ibid., p. 85); *Vitrinopsis* (Ibid., p. 86), and the numerous genera of disintegrated *Nanina;* also some species of *Limax*. The first marginals of *Z. exiguus* have a side spur.

Taking the general characters of dentition into consideration *Zonites* is nearest allied to *Limax* among our genera, but in the latter the marginals are generally more slender or spine-like, and have a less sole-like base of attachment.

The approximate count of teeth in the various species now follows:—

Zonites capnodes (pl. III., fig. 12; pl. II., fig. 6) has 66—1—66 teeth, with 9 perfect laterals on each side the median row. Another specimen gave 46—1—46 teeth, with 70 rows of teeth in all.

Z. fuliginosus (pl. II., fig. 7) gave 87 rows of 64—1—64 teeth. Another specimen 57—1—57. Both linguals have 4 perfect laterals. Fig. 6 gives the eighth marginal from the outer edge.

Z. friabilis (pl. II., fig. 4) has 57—1—57 teeth with 6 laterals. Fig. *b* gives the extreme marginals of two adjacent rows.

Z. caducus[1] is known only by the description and figure of Fischer and Crosse (Moll. Mex. et Guat. 149, pl. VIII., fig. 13–16). There are 75—1—75 teeth with 5 laterals.

Zonites lævigatus (pl. II., fig. 1, 2) is peculiar in having no cutting points to the side cusps of the central teeth, and no perfect lateral teeth. I found in one specimen 28 rows of 19—1—19 teeth. Another specimen had 17—1—17 teeth. One-half of one transverse row with the central tooth is figured on pl. II., fig. 1. A more enlarged view of a portion is given in fig. 2.

[1] I will here mention that Semper, Archip., Phil. 78, pl. III., fig. 27; pl. V., fig. 21, figures the genitalia, jaw, and dentition of a *Zonites* from Tennessee, which he refers to *Z. lucubratus*, Say. I do not know what species he had before him. *Z. lucubratus* is not found in Tennessee. See Ann. N. Y. Lyc. N. H., pl. XI., fig. 24.

Z. demissus (pl. III., fig. 6, *b* is the 15th tooth) has 45—1—45 teeth, with 15 laterals. My specimen was one of the large East Tennessee form, called *Z. acerrus* by Dr. Lewis. The typical form from near Mobile has, however, a perfectly similar dentition.

Z. ligerus (pl. III., fig. 11, *b* is the 18th tooth ; *c*, a profile of one nearer the central line). Teeth 38—1—38 with 14 laterals.

Z. intertextus (pl. III., fig. 8, *b* is from near the outer margin). I find difficulty in counting the teeth on one specimen examined by me, but I believe there are 61—1—61. There are 12 perfect laterals. Another specimen has 55—1—55 with 12 laterals

Z. subplanus, not examined.

Z. inornatus (pl. II., fig. 5, fig. *b* is the 21st tooth). One specimen had 37 rows of 23—1—23 teeth. Another had 26—1—26. Both had only two perfect laterals.

Z. sculptilis (pl. III., fig. 2, *b* are extreme marginals) 40—1—40 teeth with 4 perfect laterals.

Z. Elliotti (pl. III., fig. 5, *b* an extreme marginal) 32—1—32 teeth with 6 perfect laterals.

Z. cerinoideus, not examined.

Z. cellarius (pl. II., fig. 2, one-half of one transverse line with the median tooth) 14—1—14 teeth. There can hardly be said to be one perfect lateral. For the other abnormal characters of this lingual membrane see p. 163. The figures of dentition of the foreign form (by Lehmann, Lindström, etc.) agree with mine.

Z. Whitneyi, not examined.

Z. nitidus. See Lehmann, Lebenden Schnecken, etc. p. 72, pl. X., fig. 23, for description and figure of the European form. In a specimen from Baldwin County, Alabama, furnished by Dr. E. R. Showalter, I find 25—1—25 teeth with 5 laterals—(pl. XVII., fig. 7, *b* is an extreme marginal.) Lehmann gives 28—1—28.

The specimen examined had the dart-sac and dart described in the European form.

Z. arboreus. Morse gives 82 rows of 21—1—21 teeth each. My specimen (pl. XVII., fig. 4, *b* is an extreme marginal) has about 16—1—16 with 5 perfect laterals. There are distinct side cusps as well as cutting points to the central and lateral teeth.

Z. viridulus (pl. XVII., fig. 6). Morse gives 54 rows of 27—1—27 teeth each. I have figured the central and first lateral, with one extreme marginal tooth, drawn from a specimen furnished me by Mr. Allen of Orono, Maine. I find three lateral teeth.

Morse gives a similar figure. The European *Z. viridulus* as figured by Lehmann (*Z. purus*) has a similar dentition; he gives 23—1—23 teeth, with 3 laterals.

There are decided side cups as well as cutting points to central and lateral teeth.

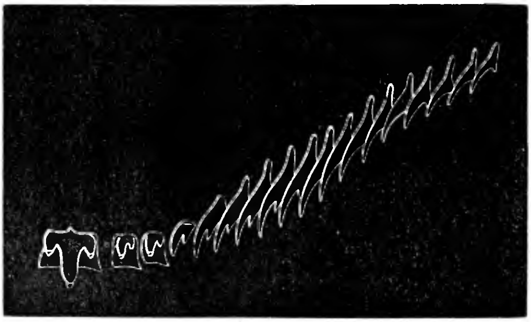
Z. indentatus (pl. XVII., fig. 3). The lingual examined has 38—1—38 teeth, with 3 perfect laterals. Morse counted 53 rows of 39—1—39 teeth, also three perfect laterals.

Z. limatulus (pl. III., fig. 3); has 23—1—23 with 5 laterals.

Z. minusculus (pl. XXI., fig. 9). Morse's figure shows four perfect laterals. He counted 52 rows of 12—1—12 teeth. It will be noticed that his figure does not show the cutting points of the side cups of the central and lateral teeth, which I have found in specimens lately examined from Florida. I found a similar number of teeth.

Z. milium is described by Morse (fig. 6), as having 68 rows, of 17—1—17 teeth, with only 2 perfect laterals. The next six teeth

Fig. 6.



Z. milium.

are shown to be bifid, not only the one or two transition teeth, but the decided marginals. I have also drawn the membrane of this species (pl. XVII., fig. 8). I found 18—1—18 teeth, with 3 laterals.

The peculiarity of the lingual of this species is the great development of the central tooth. The jaw also is peculiar in having vertical channels worn upon its anterior surface, extending down to the cutting margin (see fig. 7, copied from Morse). These chan-

Fig. 7.

Jaw of *Z. milium.* [Morse.]

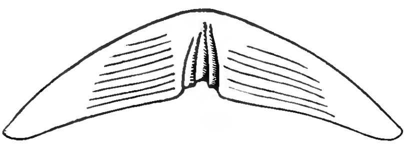
nels are probably worn by the greatly developed central tooth of the lingual membrane. I do not agree with Morse in considering the great development of the central tooth, and the channels on the jaw as generic characters.

Z. Binneyanus is described by Morse with 60 rows of 23—1—23 teeth, with two perfect laterals which have a form of inner side cutting point.

On pl. XVII., fig. 13, I give a figure of the teeth on a membrane examined by me, kindly furnished by Mr. Anson Allen, of Orono, Maine. I find 19—1—19 teeth, with 3 laterals. I doubt there being any inner cutting points to the lateral teeth.

Z. ferreus (pl. XVII., fig. 9), is described by Morse with 39 rows of 20—1—20 teeth. I found 20—1—20 teeth also, with 2 laterals. The central tooth is greatly developed, and the jaw (fig. 8) has vertical median channels, or groves, as in Z. milium (see above, fig. 7).

Fig. 8.



Jaw of *Z. ferreus.* [Morse.]

Z. conspectus, not examined.

Z. exiguus. I give here a copy of Morse's figure, having 69

Fig. 9.

Z. exiguus.

rows of 16—1—16 teeth, with 4 perfect laterals. The transition teeth and several of the adjoining marginals are described by Morse with a small side spur to their cusps, apparently of the same type as I have figured for *Macrocyclis Vancouverensis* (pl. I., fig. 4). On pl. XVII., p. 14, I give a drawing of a specimen examined by me. I found 16—1—16 teeth with 5 laterals.

Z. chersinellus, not examined.

Z. capsella (pl. III., fig. 4), 25—1—25 teeth, with 3 perfect laterals, and one transition tooth.

Z. fulvus. Morse gives 80 rows of 18—1—18 teeth, with 7 laterals. The specimen examined by me (from Orono, Maine) has 30—1—30 teeth with 8 perfect laterals. The difference in the marginals is unusual for two individuals of the same species.

The peculiarity of the lingual is the bifurcation of all the marginal teeth. On pl. XVII., fig. 5, I have drawn one central with its adjacent lateral, and one marginal extracted from a Maine specimen.

By the bifurcation of the marginals this species is allied to *Z. Gundlachi*, which, however, has even some of its marginals tricuspid, and tricuspid laterals.

The American form here under consideration was described by Mr. Say under the name *chersina*. Judging from its shell alone, it seems identical with the European *L. fulvus*. It has thus been considered one of the circumpolar species common to the three continents. My confidence of this identity is now shaken by a study of the description and figure by Lehmann (Lebenden Schnecken, etc., p. 79, pl. X., fig. 24), of the dentition of the European *Z. fulvus*. He gives 86–100 rows of 25—1—25 teeth, the first two laterals he makes tricuspid, while they are only bicuspid in our form. The marginals appear to be bifid. The question of identity must therefore be considered as still open.

Z. Fabricii, not examined.

Z. Gundlachi (pl. III., fig. 10, *b*, shows two marginals from two adjoining transverse rows), 23—1—23 teeth, with 4 perfect laterals. This lingual is peculiar in having its marginals bluntly bifid, as in *Nanina* and *Vitrina*. Some of the marginals are even trifid. The laterals are also tricuspid.

Z. Stearnsi, not examined.

Z. gularis (pl. III., fig. 1), has 30—1—30 teeth, with 10 perfect laterals.

Z. suppressus (pl. XVI., fig. 2, *b* are marginals from near the edge of the membrane). Teeth 30—1—30, with 8 perfect laterals.

Z. lasmodon (pl. III., fig. 7, *b* the smaller figure shows the 38th tooth). Teeth 41—1—41, with 9 perfect laterals.

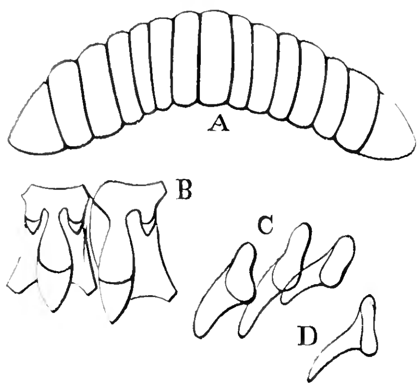
Z. significans (pl. XVII., fig. 10). 16—1—16, with 2 perfect laterals.

Z. internus (pl. III., fig. 9, *b* shows the 17th and 18th teeth, *c* the last tooth). Teeth 28—1—28, with 4 laterals.

Z. multidentatus (pl. XVII., fig. 1). The lingual examined had 14—1—14 teeth, with 2 perfect laterals. Morse gives 68 rows with 15—1—15 teeth, also 2 perfect laterals.

After my paper was prepared I have had an opportunity of examining the jaw and tongue of *Z. Lansingi.* It will be seen below that its ribbed jaw and aculeate marginal teeth do not sustain my assertion (p. 146) that for the larger divisions these organs may be relied on as systematic characters. The result of my examination of this species was as unexpected as it is puzzling.

Fig. 10.



Jaw (fig. 10, A) low, wide, slightly arcuate; ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with 14 broad, unequal, crowded, flat ribs, slightly denticulating either margin.

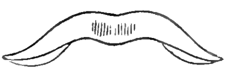
The first impression given by the jaw is that it bears narrow, separated ribs, as in *Bulimulus*, *Cylindrella*, etc. A more careful study of it, however, shows the ribs to be very broad, crowded, flat, with narrow interstices between them.

Lingual membrane with 17—1—17 teeth: 6 laterals. Centrals (fig. 10, B) with the base of attachment longer than wide, the lower lateral angles expanded; upper margin broadly reflected; reflection very short, tricuspid; side cusps decidedly developed, short, bearing distinct cutting points; median cusp long, slender, bulging at sides, reaching nearly to the lower edge of the base of attachment, beyond which projects slightly the distinct, long cutting point. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower angle of the base of attachment, and inner side cusp and cutting point. Marginals (C) aculeate, their bases of attachment less sole-like than in *Zonites*, but more circular in outline.

Fig. 10, C, shows these bases of attachment. Fig. 10, D, gives one marginal tooth in profile.

This is the first known instance of a species with ribs on its jaw having aculeate marginal teeth, or of a species furnished with a *Zonites*-like shell having decided ribs upon the jaw. It will be difficult to find a place for the species under any description of genus or subfamily. The shell is that of *Zonites*, but that genus has a ribless jaw with median projection.

Fig. 11.



Jaw of *Z. arboreus*. [Morse.]

Fig. 12.

Jaw of *Z. fuliginosus*.

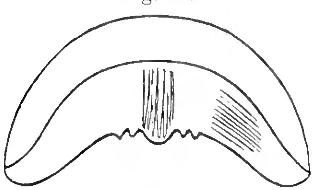
Fig. 13.

Jaw of *Z. indentatus*. [Morse.]

The jaw of *Zonites* is arcuate, ends acuminated, often recurved; anterior surface without ribs; cutting margin with a beak-like projection.

I have examined the jaws of almost all the species enumerated above. There is considerable variation in their form, but the general characters are constant. Sometimes there is a vertical median carina, as in *Z. minusculus*. Some species have vertical striæ, especially on the middle of the jaw (see fig. 14). Some have strong transverse lines of reinforcement (see fig. 12). In several species, such as *Z. viridulus* and *Z. Binneyanus* (fig. 14), Morse has detected projecting points on the cutting edge of the side of the median beak. But I did not find them in a specimen of the last species examined by me; it is very high. That of *Z. exiguus* is very low. The median vertical grooves in some species have been mentioned above (fig. 7 and 8).

Fig. 14.



Jaw of *Z. Binneyanus*. [Morse.]

Formerly I separated the above species into two genera, *Zonites* and *Hyalina*, respectively characterized by the presence or absence of a distinct locomotive disk to the foot, and well-marked furrows running above, and parallel to, the edge of the foot, meeting above the extremity of the tail over a distinct caudal mucous pore (fig. 15). I now place them all in *Zonites*, as all I have examined are so characterized, and I believe all will prove to be so. (See Ann. N. Y. Lyc. N. H., X. 164.)[1]

Fig. 15.

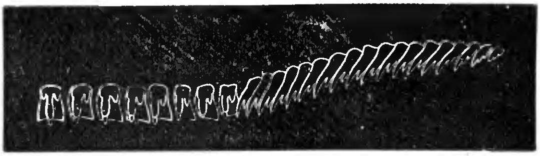
Tail of *Zonites suppressus*, enlarged.

The external orifice of the generative organs in the species I have examined is quite under the mantle, not on the right side of the head, as inadvertently stated on p. 29 of L. and Frw. Shells, I.

Genus **VITRINA**, Drap.

To the description of the animal on p. 29 of L. and Frw. Sh. N. A., I., must be added the fact of there being a distinct locomotive disk to the foot.

Fig. 16.



Lingual dentition of *V. limpida*. [Morse.]

The jaw is highly arched, ends acuminated, blunt; anterior surface smooth; cutting margin with a prominent beak-like median projection. I have figured the jaw of *V. limpida* on pl. XVI., fig. 3. I have found it to be the same in *V. exilis* and *Pfeifferi*. I have not examined either jaw or lingual membrane in *V. Angelicæ*. Fig. 16 gives a general idea of the lingual membrane. The centrals have a quadrangular base of attachment, longer than broad.

[1] I have also observed the caudal pore in *limatulus*. *Z. arboreus* has the longitudinal furrows, but on account of the transparent tissue of the foot I find it difficult to distinguish any caudal pore.

In *Z. ligerus* there are well-marked lines running obliquely towards the centre of the base of the foot, where is an extremely narrow line, representing, no doubt, the locomotive disk. The other characters of *Zonites* are present in the species.

The reflection is short, with three distinct cusps, the median long and slender, bulging at the sides, the outer ones very short; all the cusps bear cutting points in proportion to their length. The lateral teeth are arranged in straight transverse rows. They are like the centrals, but unsymmetrical by the partial suppression of the inner side cusp and inner lower lateral expansion of the base of attachment, and the complete suppression of the cutting point to the inner side cusp. The marginals have a sole-shaped base of attachment, and truly aculeate cutting points, which, however, are bluntly bifid at their points. The marginals are in oblique, curving rows, gradually decreasing in size of the teeth as they pass off laterally. They do not first increase and then decrease, as in *Zonites* and *Glandina*, or not, at all events, to the same degree. In *V. limpida*, as stated below, the seventh marginal appears, however, to be the largest.

In *V. limpida* I have counted 30—1—30 teeth, with 9 perfect laterals. The seventh marginal is the largest. Another gave 39—1—39, with 10 perfect laterals. The membrane figured by Morse had 25—1—25 teeth, with 9 laterals. I have figured of this species on pl. IV. one central and its adjacent lateral in fig. 8 *a*. and the twenty-third tooth, which is one of the marginals, in fig. 8 *b*.

Vitrina exilis has about 37—1—37 teeth, with 7 perfect laterals. I have given on pl. IV., fig. 7 *a*, one central and lateral; *b*, a group of marginals; *c*, an extreme marginal.

Vitrina Pfeifferi has over 50—1—50, with 10 perfect laterals. I figure a group of centrals and laterals, pl. IV., fig. 6 *a*, and one extreme marginal in *b*.

Genus **LIMAX**, Lin.

The character of the mantle and the peculiarities of the lingual dentition have suggested various subdivisions of this genus into sections, sub-genera, and even genera. I propose, however, to consider the genus in its widest sense, as generally adopted. It will be seen that even in the few species existing in North America, there is considerable variation in the lingual dentition, especially in the bifurcation or non-bifurcation of the marginal teeth, the development of the side cusps to the central and lateral teeth, and the presence or absence of distinct cutting points to these cusps. I shall, however, simply describe the dentition of our species, leaving the question of subgeneric division to the future, and to abler hands.

As some confusion exists in regard to the specimens furnishing the descriptions and figures published in this country, I have taken pains to be sure of the specific identity of each specimen now before me.

The *L. maximus* was collected in Newport, R. I., by my friend, Mr. Sam. Powel. It is the same individual figured on p. 408 of my edition of Gould's Invertebrata of Massachusetts. The external markings of the animal are conclusive proofs of its identity with the European species. I have, however, made it still more certain by examining the genitalia, which I find agree with those of *L. maximus*, figured by Lehmann (Lebenden Schnecken, etc.). I find the dentition agrees also with the figures given by Heynemann (Malak. Blatt. X.), Lehmann (l. c.), and Goldfuss (Verhl. Naturh. Vereins der Preuss. Rheinl., etc.).

The *L. flavus* was collected in a cellar in Burlington, N. J. It not only agrees with the figure in the "Terrestrial Mollusks" as far as its outward markings are concerned, but I find also its genitalia to agree with Dr. Leidy's figure in the same work, and also with the figure given by Moquin-Tandon (Moll. Fr.). Its dentition agrees with the figures of Heynemann and Semper (Arch. Phil.).

The *L. agrestis* was collected in a garden in Burlington, N. J. This species I have also found to agree with the figures of the external animal and genitalia given in the "Terrestrial Mollusks," as well as with Moquin-Tandon's (Moll. Terr. et Fluv. de la France) figure of the genitalia, and Heynemann's and Lehmann's figure of the dentition; also with the figure of the genitalia given by Schmidt and Lehmann.

The *Limax campestris* examined was collected in the country near Burlington, N. J., by my friend, A. Ten Eyck Lansing. It agrees with the description and figures in the "Terrestrial Mollusks," not only as to its external characters, but in its genitalia. I will here mention that its dentition does not agree with that of *L. Weinlandi*, Heynemann (l. c. p. 212), supposed by that author to be the same species.

The *Limax Hewstoni* examined is a typical specimen, given by Dr. J. G. Cooper to the State Collection of California. It was labelled by him. There can be no doubt, therefore, of its identity.

The *Limax Ingersolli* was received since this paper was commenced. It has not yet been described.

Being thus confident of the identity of the species before me, I will proceed to describe their jaws and dentition in detail.

I have examined the jaw of all the species, finding it to agree with the well-known character of the jaw in the genus. It is arcuate with slightly attenuated, but blunt ends; anterior surface smooth, cutting margin with a decided beak-like median projection. There is often a central vertical carina to the jaw. The ends are often more pointed than in the jaw figured.

Fig. 17.

Jaw of *Limax*.

Limax maximus, Linn. (pl. IV., fig. 4) has about 76—1—76 teeth. The centrals have a large, subquadrate base of attachment. The reflection is large, subquadrate, and bears a single stout median cusp, which has a short cutting point, often longer than in the teeth figured; the side cusps are subobsolete, and bear no cutting points. The lateral teeth, about 18 in number, are like the centrals, but unsymmetrical. The marginal teeth are aculeate. Only a few are simple, as in fig. *b*, the balance are bifid, as in fig. *c*. The bifurcation of the marginals commences much nearer the median line than in the specimens examined by Lehmann and Heynemann. There are, indeed, but twelve marginals without the bifurcation on one membrane examined.

Limax flavus,[1] Linn. (pl. IV., fig. 1). The specimen examined has about 60—1—60 teeth, with 16 laterals. The centrals and laterals are of the same type as in *L. maximus*, the outer marginals are also bifid. Pl. IV., fig. 1, represents the dentition of the species. On other portions of the same membrane the cutting points are longer and sharper. Fig. *c* represents an extreme marginal. Both of the figures of this species, published by me,[2] were drawn from lingual membranes of another species.

Limax agrestis,[3] Linn. (pl. IV., fig. 3, *a. b. c.*) has about 50—1—

[1] L. and Frw. Sh. N. A., I. p. 63, fig. 105, is no doubt *L. agrestis*. Fig. 6, p. 285, of Ann. Lyc. N. H., N. Y., vol. IX., would more correctly represent the dentition of this species, if the extreme marginals were bifid.

[2] The description and figure given by Morse (Journ. Portland Soc. N. H. 1864, 7, fig. 1) of the jaw of this species could not have been drawn from any *Limax*, as it is said to be ribbed. The figure of the lingual membrane, also (pl. III., fig. 2), does not give the impression of aculeate marginals.

[3] The figure given of the marginals of *L. agrestis*, by Lindström (Gotlands

50 teeth, with 18 perfect laterals. The centrals have a much more graceful outline to the reflection than in the two last-named species. The median cusp is longer and more slender, with a more slender cutting point; the subobsolete side cusps are more marked, and bear well developed, triangular, slightly curved cutting points. The lateral teeth are like the centrals, but unsymmetrical by the suppression of the inner lateral lower expansion of the base of attachment. There is, however, an inner cutting point lying against the inner side of the cusp, rather than in a position corresponding to the outer cutting point; it is very difficult of detection, being on a different plane from the outer cutting point, and readily confounded with the inner lower angle of the base of attachment. It is figured by Lehmann and Heynemann. The marginals are long and slender, without bifurcation even on those on the extreme edge of the membrane. Fig. 105 of p. 63 of L. and Frw. Shells N. A. I., probably was drawn from a specimen of this species, certainly not from one of *flavus*.

Goldfuss (l. c. pl. V., fig. 4) omits the cutting points from his figure.

Limax Hewstoni, J. G. Cooper (pl. IV., fig. 2). The centrals and laterals are of the same type as in the last species, with this important difference, that there is a well-developed cutting point of the usual form (not the peculiar form as in *L. agrestis*) to the inner subobsolete cusp of the laterals, and the inner lower lateral expansion of the base of attachment of the laterals is not suppressed as usual to make the laterals unsymmetrical. From this it follows that the central teeth are with difficulty distinguished from the laterals, until the outer ones are reached, when the inner cutting point and inner lower lateral expansion of the base of attachment are suppressed as in the other species of *Limax*. The marginal teeth are not bifid. Teeth 30—1—30, with 14 perfect laterals. Fig. *b* represents the very last marginals. As in the membranes of almost all species of land shells, there is considerable difference in the marginals on different portions of the same membrane. Those figured are the least slender.

This species, by the presence of the inner cutting point of the laterals and non-bifurcation of the marginals, resembles *Limax* (*Amalia*) *gagates*, as figured by Semper (Phil. Archip., pl. XI.), and

nutida Mollusker, pl. I., fig. 3), disagrees with my observation by the bifurcation of the marginals.

Amalia marginata, as figured by Heynemann (l. c. pl. III., fig. 7). Goldfuss also (l. c. 1856, pl. IV., fig. 3) figures the dentition of *L. marginatus* as the same.

Limax campestris, Binney (pl. IV., fig. 5, *a. b. c.*). One specimen has 40—1—40 teeth, 18 perfect laterals. Another gives 36—1—36, with 11 perfect laterals. The centrals and laterals are of the same type as described above in *L. agrestis*, excepting that there is no peculiar inner side cutting point to the first laterals. About half of the marginals are bifid. I find great difficulty, however, in detecting any bifurcation on the extreme marginals.

As stated above, Heynemann's figure of the dentition of *L. Weinlandi* could not have been drawn from this species. I have no information in regard to *L. Weinlandi* other than what I find in Malak. Blatt. X. 212, pl. III., fig. 1. Judging from the dentition alone I should hardly consider it distinct from *agrestis*.

L. campestris differs greatly in its genitalia from *L. agrestis*, to which it has been compared.

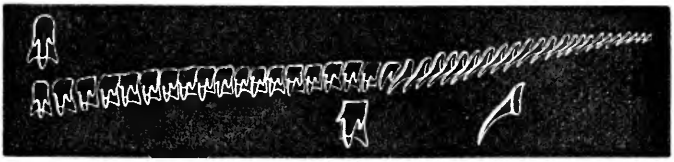
This completes the list of North American *Limaces* now known. I will add that *maximus* and *flavus* are put by Heynemann in the s. g. *Heynemannia; agrestis* in s. g. *Agriolimax; campestris* would be placed by him in s. g. *Malacolimax;* while *Hewstoni* would be placed by him in the genus *Amalia.*

Since the above was written I have received specimens collected in the mountains of Colorado by Mr. Ernest Ingersoll, of a species for which I propose the name *L. Ingersolli.* A full description will be published later. I will here simply state that there are 50—1—50 teeth, with 16 perfect laterals. All the marginals have a blunt spur to the cutting point, so that they may be said to be bluntly bifid.

The dentition of *Limax* is nearly allied to that of *Zonites.* The lateral teeth are arranged in straight transverse rows, the marginals in oblique rows, as aculeate marginal teeth always are. This tendency to obliquity in the rows of aculeate teeth we have seen most plainly shown in *Glandina.* To show the general arrangement of the teeth in straight and oblique rows I repeat the figure by Morse in L. and Frw. Sh. N. A. I., which was probably drawn from *L. agrestis.* It must be borne in mind that this figure is not intended to show the characters of the separate teeth, for which I refer to my plate.

The genus *Limax* differs from *Zonites* in its dentition by having more slender, spine-like marginals, instead of the short, strictly aculeate form. The base of attachment of the marginals in *Limax* is also different, being less sole-like, and more irregularly circular on the extreme marginals. Another difference is

Fig. 18.



Lingual dentition of *Limax*.

that the marginal teeth do not increase in size so rapidly, and then decrease gradually as they pass off laterally, thus giving an irregularly crescentic form to each half of every transverse row. In *L. maximus* the marginal teeth decrease gradually in size from the first to the last. It is the same with *agrestis*, and I believe the character to be generic.

b. Jaw in one single piece, marginal teeth quadrate.—HELICINÆ.

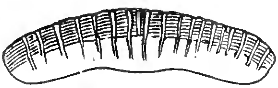
In grouping the genera of *Helicinæ*, I have placed (1) those whose jaw has no distinct ribs upon its anterior surface; (2) those whose jaw has decided stout vertical anterior ribs; (3) those whose jaw has delicate, distant ribs generally running obliquely towards the median line of the jaw.

(1) Jaw without decided ribs on its anterior surface.

Genus **PATULA**, Held.

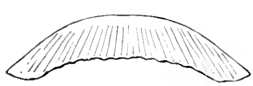
In none of the American species of this genus have I found a jaw with distinct well-formed ribs as in *Helix*. In several species,

Fig. 19.



Jaw of *Patula asteriscus*. [Morse.]

Fig. 20.



Jaw of *Patula striatella*. [Morse.]

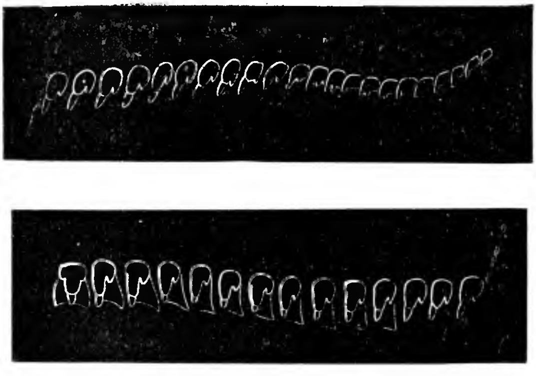
Fig. 21.

Jaw of *P. alternata*.

however, such as *strigosa* and *Cooperi*, there are distinct traces of subobsolete ribs near the cutting margin. In *asteriscus* there are coarse wrinkles, resembling subobsolete ribs. In *perspectiva*, *striatella*, and *Idahoensis* there are such wrinkles, and also coarse vertical striæ. I have not found the striæ as oblique as shown in fig. 20. In *solitara*, *alternata*, and *Hemphilli* there are no traces of either ribs, wrinkles or striæ. In all these species there is a tendency to a median projection to the cutting edge. This is greatly developed in *solitaria*, *alternata*, and especially in *Hemphilli*. The last two species have also a much more arcuate jaw than the others. I have not seen the jaw of *Haydeni*, *Cumberlandiana*,[1] *tenuistriata*, *Horni*, *pauper*, *incrustata*, or *vortex*.

Patula is described by von Martens as having a ribbed jaw, which does not agree with my observations on the jaw of our North American species. As there appears considerable confusion in regard to the limits of the genus, I think it best to make no reference here to any species foreign to America.

Fig. 22.



Lingual dentition of *P. alternata*. [Morse.]

Fig. 22 shows the general arrangement of the teeth on the membrane. The characters of the individual teeth are better shown on my plate VII.

There is considerable difference in the lingual dentition of the species I have grouped in this genus as to the development of the side cusps to the central and lateral teeth, and the presence of dis-

[1] I have lately received a specimen from University Place, Tenn., from Dr. Elliott. The jaw has very coarse perpendicular striæ.

tinct cutting points upon these cusps. Such cusps and points are present in *solitaria* (pl. VII., fig. 9), *alternata* (fig. 5), *perspectiva* (fig. 3), *striatella* (fig. 10), *Hemphilli* (fig. 6), *Idahoensis* (fig. 4), *asteriscus* (pl. XVIII., fig. 9).

I do not detect these cusps in *P. strigosa* (pl. VII., fig. 1), *Cooperi* (fig. 2), probably the same species, or *Cumberlandiana*, excepting on the outer laterals (see pl. VII., fig. 1 *d*).

The central and lateral teeth of all the species examined by me are, in other respects, as usual in the *Helicinæ*. It will be noticed that the base of attachment is subquadrate, the reflected portion large (except in *asteriscus*), the cusps short, the cutting points short.

All the outlines of the teeth are less graceful than in *Zonites*. The lateral teeth are made unsymmetrical by the suppression of the inner lower angle of the base of attachment, and the less development, if not suppression, of the inner cusp, which loses the cutting point also. The marginal teeth are quite different from those of *Zonites*, *Limax*, *Vitrina*, *Macrocyclis*, and *Glandina* in not being aculeate. They are more crowded than in those genera. They have a quadrate base of attachment, not sole-like, shortened on its inner lower side, but produced at its outer lower margin. The reflected portion is as wide as the base of attachment, is more produced than in the central and lateral teeth, retains its width throughout, and bears two oblique, blunt cutting points, the inner one always much the larger and longer, and the outer one of which, in most of the species, has a tendency to bifurcation. There is considerable variation in these cutting points even in the same lingual membrane, but as a general thing it may be said that the marginal teeth are but a modification of the form of the laterals. They decrease in size greatly at the outer edge of the lingual membrane.

It must be borne in mind that the cutting points vary in development on different portions of any one lingual membrane. I have in each case chosen for drawing such individual teeth as appear best to illustrate the general character of the dentition.

In *P. strigosa* (pl. VII., fig. 1) there are 50—1—50 teeth, with 15 perfect laterals, *c* is an extreme marginal. I give in fig. *e* a central tooth drawn from the membrane of an embryonic young found in the oviduct.

P. solitaria (pl. VII., fig. 9) has 25—1—25 teeth, with 14 perfect laterals. The transition to marginals is very gradual.

P. Cooperi (pl. VII., fig. 2), 29—1—29, with 11 perfect laterals.

P. Hemphilli (pl. VII., fig. 6) has 20—1—20 teeth, with 7 perfect laterals.

P. Idahoensis (pl. VII., fig. 4) has 33—1—33 teeth, with 14 perfect laterals. The transition from the laterals to the marginals, however, is very gradual.

P. Haydeni not examined.

P. alternata (pl. VII., fig. 5). One membrane has 121 rows of 34—1—34 teeth, ten of which are perfect laterals. The variety *mordax*, pl. VII., fig. 7, agrees with it in dentition, except the number of teeth. I counted 20—1—20, with 5 perfect laterals.

P. Cumberlandiana (pl. VII., fig. 8) has 24—1—24 teeth, with about 13 perfect laterals. There is an appearance of a side cutting point to the third tooth, a decided one beyond the sixth.

P. tenuistriata, not examined.

P. perspectiva (pl. VII., fig. 3), 15—1—15 teeth, 7 perfect laterals.

P. striatella (pl. VII., fig. 10), 20—1—20 teeth, with 8 perfect laterals. Morse gives 16—1—16.

P. vortex (pl. XX., fig. 4), 18—1—18, with 8 laterals. A marginal tooth is shown in *b*.

P. Ingersolli, Bland. The species should, perhaps, be placed in *Microphysa*. Jaw of same type as in *H. Lansingi* (above), with 22 ribs. Teeth 16—1—16, with a gradual change from laterals to marginals. The latter are low, wide, with one inner, long, blunt cutting point, and one outer, small, blunt. The side cusps and cutting points of centrals and laterals are well developed.

P. pauper, *Horni*, *incrustata*, not examined.

P. asteriscus (pl. XVIII., fig. 9). Morse gives 77 rows of 13—1—13 teeth; 6 perfect laterals. I counted 11—1—11, with 5 perfect laterals. The reflected portion of the central teeth is quite small. The marginal teeth are like those of *Pupa*.

It will be seen that *Patula* differs from all the preceding genera by the presence of quadrate, not aculeate, marginal teeth, a character shared by all the succeeding genera. There does not appear any very essential character in the dentition by which to distinguish it from many of American sub-genera of *Helix*, as will be seen below. It will be noticed that one species, *asteriscus*, has marginal teeth like those of *Pupa* and *Vertigo*.

Genus **HEMITROCHUS**, Sw.

In Ann. Lyc. N. H. of N. Y., X., 341, I have, in connection with my friend Mr. Bland, shown the necessity of using this name in preference to *Polymita*.

The jaw is arched with acuminated ends, smooth anterior surface, and decided median prominence to cutting margin. Fig. 23 represents the jaw of *H. varians*. The lingual membrane (pl. XIII., fig. 1) has about 33—1—33 teeth, another specimen gave 43—1—43 teeth, with 17 perfect laterals. The central tooth has a long, narrow base of attachment with lower, outer angular expansions and incurved lower margin. The reflected portion is only about one-half the length of the base of attachment, is short, and bears one short, stout cusp with an equally short, stout cutting point; the side cusps and cutting points are obsolete. The laterals are the same as the centrals, but unsymmetrical. The outer laterals have a side cusp and cutting point. The marginals are low, wide, and have one broad, long, oblique, bluntly bifid cutting point, the inner division the smaller, and a very much shorter side cutting point. This side cutting point is also sometimes bluntly bifid in the extreme marginal teeth.

Fig. 23.

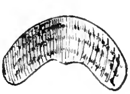
Jaw of *H. varians*.

The dentition of the other species of this genus, extralimital to North America, examined by me, agrees with that of this species. (See Pr. Phila. Ac. N. S., 1874, 56.)

Genus **TEBENNOPHORUS**, Binn.

One species only is known to exist in North America, *T. Caroliniensis*. It has an arched jaw (fig. 24), with blunt, scarcely attenuated ends, ribless anterior surface, and decided blunt median projection to the cutting edge. The jaw is thick, coarse, with vertical and parallel transverse lines of reinforcement, but has no appearance of ribs. I have verified this fact by examining numerous specimens of all ages from various parts of the country. My observations have been confirmed by Morse, also (Journ. Portland Soc. N. H. 1864, 7). I am therefore inclined to doubt the identity of the

Fig. 24.

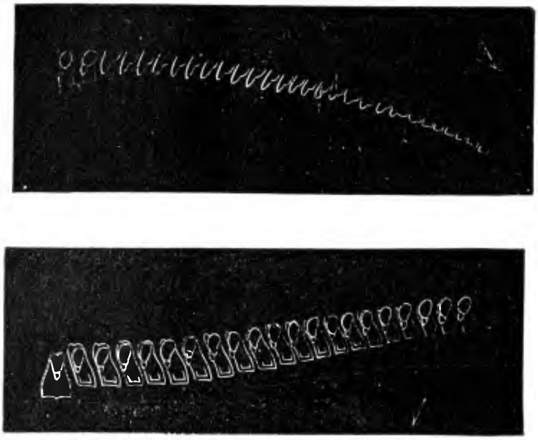


Jaw of *Tebennophorus caroliniensis*.

specimen which Heynemann (Mal. Blatt. 1862, pl. III., fig. 12) describes with a ribbed jaw. Bergh (Zool. Bot. Gesell. in Wien, XX. 833) suggests that Heynemann may have had *Pallifera dorsalis* before him. Mörch, Journ. de Conch. 1865, suggests that it may have been *Veronicella Floridana.* At all events I do not believe it could have been the species now under consideration. I suspect it to have been *Pallifera Wetherbyi.* (See Ann. Lyc. Nat. Hist. of N. Y., XI. 31.)

The lingual membrane is arranged, as usual in the *Helicinæ*, as shown in fig. 25. It must be borne in mind that I offer this

Fig. 25.



T. Caroliniensis. (Morse.)

figure simply to show the general arrangement of the teeth—the form of the individual teeth being much more accurately given in pl. VI., fig 1. Morse counted 115 rows of 56—1—56 teeth, another membrane gave 49—1—49 teeth, with 22 perfect laterals; I have myself counted 56—1—56 teeth, with 11 perfect laterals. The central teeth *a* have a very long narrow base of attachment widening towards the lower margin, which is excavated. There is a line of reinforcement running parallel to the lower edge, and for a short distance along the sides. The reflected portion equals only one-fourth of the length of the base of attachment. It is stout and bears a short, stout, median cusp, having a short, blunt, cutting point. There are no side cusps or cutting points.

The laterals *b* are like the centrals, but unsymmetrical; their reflected portion is also longer. The outer laterals (*e*) have an outer side cusp.

The marginals *d* are a simple modification of the laterals, being quadrate, longer than wide, with one inner broad, long, oblique, bluntly pointed cutting point, bearing an inner, side, short, acute cutting point. These cutting points on the extreme marginals *e* are simply short and bluntly rounded.

Some membranes examined by me seemed to have an extension to the base of attachment beyond the upper margin of the reflected portion, to which it was parallel.

This membrane is peculiar in the long, narrow base of attachment and short reflected portion of the central and first lateral teeth.

Genus **HOLOSPIRA**, Mart. & Alb.

There are two species of this genus found within our limits, *H. Goldfussi* and *Roemeri*, the former of which I have been able to examine. I have not been able to examine lingual membrane of *H. Rœmeri*, but, thanks to Mr. Bland, I have examined and here figure (pl. XX., fig. 10) that of *H. Goldfussi*. There are 26—1—26 teeth, with about 9 laterals. The cusps of the marginals are quite widely separated. The general characters of the teeth are as described below. I can refer also to Messrs. Fischer and Crosse for information regarding the jaw and dentition (Journ. de Conch. XVIII. 13, 1870, pl. V., and Moll. Mex. et Guat., 320, pl. XVI.) The jaw is arcuate, with slighly acuminated, blunt ends, thin, anterior surface ribless; cutting edge simple; transversely and vertically striated.

The lingual membrane in *H. Tryoni* and *Pfeifferi* examined and figured by those authors, is of the usual *Helicinæ* type. The centrals and laterals have a single short cusp, bearing a short, blunt cutting point, both side cusps and side cutting points being absent; marginal teeth quadrate, wide, low, with one long, inner, obtuse cutting point, and one outer, side, short, blunt cutting point.

Genus **HELICODISCUS**, Morse.

Jaw according to Morse, of the only known species, *H. lineatus*, low, wide, cresentic, ends much attenuated, acute; cutting margin with a median, beak-like projection; anterior surface without ribs, but covered with striæ converging obliquely towards the beak-like prominence.

Fig. 26.

Jaw of *H. lineatus*. [Morse.]

According to my rule of admitting in the genus *Helix* only such species as have a ribbed jaw, I am forced to recognize *lineatus* as a distinct genus. Fig. 27 shows the general arrangement of the teeth upon the lingual membrane. The characters of the separate teeth are better shown in my plate XIII., fig. 5. Morse gives 77 rows of 12—1—12 teeth, each with 4 perfect laterals. Leidy, in Terr. Moll. U. S., II. 262, fig., gives 13—1—13 teeth, with 5 perfect laterals. The membrane examined by me has 12—1—12 teeth, with 4 perfect laterals. The central teeth have a base of attachment very small, longer than wide, with expanded lower angles, and reflected upper margin. Reflection very small, with a stout, short, median cusp, and very short, blunt side cusps, all the cusps with short cutting points. The lateral teeth have a base of attachment three times as wide, and somewhat longer than the centrals, and unsymmetrical by the suppression of the inner, lower lateral expansion; the upper margin is broadly reflected; the reflection is short but symmetrical, having two equally developed short, stout side cusps, bearing short cutting points; the median cusp is stout, long, extending nearly to the lower edge of the base of attachment, beyond which projects slightly the short cutting point.

Fig. 27.

Lingual dentition of *H. lineatus*. [Morse.]

The marginals are low and wide, the reflection as broad as the base of attachment, reaching nearly to its lower edge, and furnished with one inner, long, bluntly bifid, stout, oblique cutting point, and two or more short outer cutting points. The same form of marginal is found in *Pupa*.

The membrane is very peculiar in the lateral teeth, not only from their large size, but also from their symmetrical, tricuspid reflection, quite like the usual arrangement of central teeth in the *Helicidæ*.

Genus **FERUSSACIA**, Risso.

The jaw (see pl. XVI., fig. 5 of that of the only species found in our limits, *F. subcylindrica*, Lin.) is low, slightly arcuate, wide, with but slightly attenuated, blunt ends; cutting edge with a slightly produced, wide, median projection; anterior surface without ribs, but with fine vertical striæ. There is a strong muscular attachment on its upper margin.

Figure 28 gives the general arrangement of the teeth, the characters of the separate teeth being better shown on pl. XV., fig. 9.

Fig. 28.

F. subcylindrica.

This figure, as well as that of the jaw, I drew from a Maine specimen, furnished by Mr. Anson Allen. There were 24—1—24 teeth, with 8 perfect laterals. The central teeth are small and narrow in proportion to the laterals, with a long, narrow base of attachment, expanding at its lower angles. The reflected portion is very small, tricuspid; the central cusp stout, short; the side cusps small, blunt; all the cusps bear short cutting points.

The lateral teeth are about as wide as high in their base of attachment, which is subrectangular. The whole upper edge is squarely reflected. The reflection is very short, and bears a stout, blunt, long, inner cusp, reaching almost to the lower edge of the base of attachment, and bearing a long, blunt cutting point, which reaches beyond the lower edge. The outer side cusp of the reflection is widely separated from the inner cusp, is very short, bluntly rounded, and bears a short, blunt cutting point. The first mar-

13

ginals (fig. *b*) are but a modification of these laterals, by the greater development of the reflection, and shortening of the inner cusp. The outer marginals (fig. *c*) become wide, low, irregular in shape; the upper edge broadly reflected, the reflection reaching the lower edge of the base of attachment, and bearing along its whole length numerous (6 or 8 in some teeth) short subequal denticles, some bluntly rounded, others longer and sharp, giving a pectinate appearance.

My study of this membrane confirms my belief of the identity of the species with the European form. I have carefully compared the dentition of our form with that described and figured by Lehmann (Lebenden Schnecken, 132, pl. XIII., fig. 44), and find them to agree. I must, therefore, disagree with the decision of Morse (Journ. Portl. Soc.). I have also examined the genitalia of our species, and found it to agree with Lehmann's figure (l. c.), especially in the existence of the very peculiar flagellum to the penis sac. This, however, cannot be considered as a most reliable specific character peculiar to this species, as it exists also in *Cæci lianella acicula.*

I am very confident of the presence of well-developed side cusps to the central teeth, which Morse (l. c.) does not figure, though they are figured by Thomson, Ann. Mag. N. H., VII., pl. IV., fig. 8. They appear to me also to bear the short cutting points which I have figured.

Genus **CÆCILIANELLA**, Bourg.

I have not been able to examine the jaw or dentition of *C. acicula* (*Cionella acicula* of L. and Frw. Shells, I. 227), the only species found in our limits. They are both well known, however, from the descriptions and figures of Moquin-Tandon, Thomson, Sordelli,[1] and Lehmann. The jaw is low, wide, arcuate, with delicate vertical striæ. The lingual membrane (Lehmann, Lebenden Schnecken, p. 128, pl. XIII., fig. 43) has 120 rows of 11—1—11 teeth each. The centrals are small, tricuspid (Sordelli), the laterals, six in number, are larger, and have a more highly developed reflection, and are also distinctly tricuspid. Marginals subquadrate, with a broad reflection, bearing delicate denticles.

[1] Sordelli (Atti della Soc. Italiana di Sc. Nat. XIII., fasc. 1, p. 50, pl. i. f. 25) describes the ribs to be not straight, but curving, with a median point projecting toward the end of the jaw, so that each rib resembles quite exactly the sign called "brace" by printers.

Genus **STENOGYRA**, Shuttl.

I have not been able to examine *S. octonoides* (*S. subula* of L. and Frw. Shells, I.) or *S. gracillima*, but only *S. decollata*, Lin., from Charleston,[1] S. C., a species introduced from Europe by commerce, and the true *S. subula* found near Mobile, Ala. Of extralimital species I have examined *S. octona*, *gonostoma*, and *hasta*. Semper has examined *S. Panayensis*.

The jaw (see pl. XVI., fig. 1, for that of *S. subula*) is low, wide, with attenuated, blunt ends, and a wide, slightly produced median projection. There are distinct vertical striæ on that of *S. decollata*.

The lingual membrane is long and narrow. The central tooth has a very small, high, narrow base of attachment, the lower outer angles generally somewhat expanded. The reflected portion is very small, and bears a short, stout, median cusp, and two very small side cusps; all the cusps bear distinct cutting points. The lateral teeth are very much larger than the centrals. The base of attachment is about as high as wide, its inner lower lateral expansion suppressed as usual. The upper edge is squarely reflected. The reflection is very large, and bears one stout median cusp, extending almost to the lower edge of the base of attachment; there is also an outer, much smaller side cusp, and a less developed, sometimes subobsolete inner side cusp; all the cusps have distinct cutting points, proportioned to their size; that on the central cusp being greatly developed. In *S. decollata* (pl. XV., fig. 5) the inner cutting point is also much developed, and joined to the central cutting point. The marginal teeth in *S. decollata* are but a modification of the laterals, with the suppression of the inner cusp and cutting point (*b*); the extreme marginals (*c*) differ in the greater development of the reflected portion and equalization with it of the cutting points, of which there are but two. In *S. subula* (pl. XV., fig. 8) the marginal teeth (*b*) have more numerous cutting points, formed by the bifurcation of the inner and outer cutting point. The second denticle from the inner side is the largest. It will be noticed that in *S. decollata* both the side cutting points of the laterals are quite thorn-shaped.

S. decollata, L. (pl. XV., fig. 5, *b* is one of the first marginals,

[1] I found the species in great numbers at various localities in this city during a recent visit (1875).

c extreme marginal)—a Charleston specimen. There are 38—1—38 teeth, with 11 perfect laterals.

S. subula, Pfr. (pl. XV., fig. 8, *b* is an extreme marginal). There are 24—1—24 teeth, with 6 perfect laterals.

Genus **PUPA**, Drap.

I have personally examined the jaw and lingual membrane in only two species, *P. fallax* (pl. XV., fig 12) and *P. rupicola* (pl. XV., fig. 2). For information about the other species I am indebted to Mr. Morse, whose figures are copied below.

The jaw is low (in *P. rupicola*, pl. XVI., fig. 7, strongly arched), wide, arcuate; ends but little attenuated in *muscorum*, *pentodon*, *fallax*, *rupicola*; acutely pointed in *corticaria*; a more or less developed, broad, blunt median projection to the cutting edge; anterior surface without ribs, but generally with vertical striæ.

Fig. 29.

P. muscorum. [Morse.]

Figure 29 gives a general view of the arrangement of the teeth on the lingual membrane. Pl. XV., fig. 2, shows more correctly the characters of the individual teeth of the genus. The membrane is long and narrow, the teeth are as in the genus *Vertigo* described below; excepting that in *Pupa* the central tooth is quite small in proportion to the laterals. The marginal teeth are irregularly denticulated, the inner denticle the largest.

Fig. 30.

Lingual dentition of *Pupa pentodon.* [Morse.]

Fig. 31.

Lingual dentition of *Pupa corticaria.* [Morse.]

P. muscorum (see fig. 29 above), has 90 rows of 14—1—14 teeth, with six perfect laterals. The figure and description of Lehmann of the European *P. muscorum*, confirm my belief in the identity of the two forms.

P. Blandi, *Hoppii*, *variolosa*, *decora*, *corpulenta*, *Rowelli*, *Californica*, *modica*, *Arizonensis*, *hordeacea*, *armifera*, *borealis*, *contracta*, and *pellucida*, not examined.

P. pentodon has 64 rows of 10—1—10 teeth, with 4 perfect laterals (fig. 30).

P. corticaria has 12—1—12 teeth, with 3 perfect laterals (fig. 31).

P. rupicola (pl. XV., fig. 2) has 11—1—11 teeth, with 5 perfect laterals.

P. fallax (pl. XV., fig. 12) has 15—1—15, with 7 perfect laterals.

Genus **VERTIGO**, Müll.

Jaw more or less arched, ends but little attenuated, blunt: anterior surface with delicate vertical striæ; cutting margin with a more or less developed median projection.

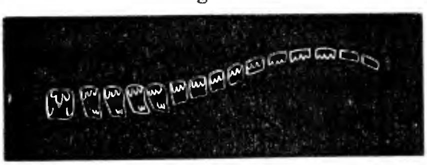
Fig. 32.

Jaw of *Vertigo ovata*. [Morse.]

I have given figure 32 copied from that of Morse. In the L. and Frw. Shells N. A., I., will be found other figures of jaws showing the variations in outline found in the genus. I have personally examined the jaw in none of our species.

For the characters of the lingual dentition I am also entirely dependent on Morse.

Fig. 33.



Lingual dentition of *Vertigo ovata*. [Morse.]

Figure 33 shows the general arrangement of the teeth on the membrane. The membrane is long and narrow. The central teeth have a base of attachment higher than wide, subrectangular. The whole upper margin is broadly reflected. The reflection is very short, and bears three short stout cusps, the central the longest, each cusp bearing (I presume) a distinct cutting point. The central tooth, in those species whose dentition is known to me, is as large as the laterals, and not smaller, as seems to be the rule in our species of *Pupa*. The lateral teeth are like the centrals, but unsymmetrical. The reflected portion is small, tricuspid or bicuspid. The marginals are wide, low, with a broad, irregular, denticulated reflection. Mr. Morse gives the following count of the teeth. *V. Gouldi* (fig. 34) has 75 rows of 11—1—11 teeth, with 7 perfect laterals. *V. Bolle-*

siana (fig. 35) has 88 rows of 12—1—12 teeth, with 6 perfect laterals. A comparison of this description and figure with that of Lehmann, pl. XIV., fig. 53, will prove that this species cannot be identical with *P. pygmæa* of Europe, as has been suggested by Mr. Gwyn Jeffreys (Ann. Mag. Nat. Hist., 1872, 246).

Fig. 34.

Lingual dentition of *Vertigo Gouldi*. [Morse.]

Fig. 35.

Lingual membrane of *Vertigo Bollesiana*. [Morse.]

V. milium, not observed.

V. ovata (see above figure 33) has 90 rows of 14—1—14 teeth apparently with 9 perfect laterals. The species has been referred to *P. antivergo*, but the figure of the dentition of that species given by Lehmann (pl. XIV., fig. 52) does not sustain the theory of identity.

V. ventricosa has 98 rows of 13—1—13 teeth, with 6 perfect laterals (fig. 36).

V. simplex, not observed.

Fig. 36.

Lingual membrane of *Vertigo ventricosa*. [Morse]

Genus **STROPHIA**, Albers.

But one species, *S. incana*, Binn., is found within our limits. I have found it to agree in the characters of its jaw and lingual membrane with the extralimital species which I have examined, *S. iostoma*, *mumia*, and *decumana*. Semper, however (Phil. Arch. 128), describes the jaw of *S. uva* as being without median projection to its cutting edge; that character, therefore, cannot be considered generic.

Fig. 37.

Jaw of *S. incana*.

Jaw of *S. incana* (fig. 37) arcuate, thick, coarse, of about equal height to its bluntly truncated ends: cutting edge with a slightly produced median projection. Anterior surface without ribs.

Fig. 38 shows the general arrangement of the teeth upon the lingual membrane. I regret not being able to give more accurately the characters of the individual teeth,[1] but have lost the membrane

Fig. 38.

Lingual dentition of *S. incana.*

in removing it for examination. There are 129 rows of 24—1—24 teeth each. See Proc. Ac. Nat. Sc. Phila., 1874, pl. VIII., fig. 1, for figure of dentition of *S. decumana.*

(2) Jaw with decided short, vertical ribs to its anterior surface.

Genus **ARION**, Fér.

I have not been able to give any information regarding two species found within our limits, *A. Andersoni* (see below, p. 194), and *A. foliolatus.* Indeed there seems so much uncertainty in regard to them, that I doubt their belonging to this genus. For fuller information, see Ann. N. Y. Lyc. of N. H., X. 297. This leaves only one species, *A. hortensis*, Fér., described and figured in Terr. Moll. U. S., and in L. and Frw. Sh. N. A., I., referred to *A. fuscus*, Müll.

The species was introduced by commerce into Boston many years ago. It still exists there,[2] specimens having been found by me in 1871, from one of which I extracted the jaw and lingual membrane here described. I have compared the figures of the genitalia of *A. hortensis* given by Lehmann and A. Schmidt[3] with those given by Leidy in Terr. Moll. U. S. There is a difference in the position of the retractor muscle of the penis. Leidy places it at the base of the penis sac, Lehmann at the top, Schmidt omitting

[1] Too late for illustration in the text, I have received specimens collected by Mr. W. W. Colkett at Key West. There are 27—1—27 teeth, of the same type as in *P. decumana*, referred to in the text.

[2] Specimens can readily be found in gardens between Chestnut and Mt. Vernon Streets above Willow Street, as well as elsewhere.

[3] Der Geschlechtsapparat der Stylommatophoren, 1855.

it entirely. The last two authors figure a retractor to the duct of the genital bladder, and so does Leidy (though in the description of the plates he refers it to the vagina). Lehmann figures a retractor also to the genital bladder itself. Lehmann's figure of the genitalia of *A. fuscus* (pl. VI., fig. 2) agrees more closely with Leidy's figure in all respects, indeed, but the position of the retractor penis, which Lehmann places at the top of the penis sac. His figure of the dentition of *fuscus* is nearer mine of the Boston specimens than is his of *hortensis*, though the transverse count of teeth is larger. Goldfuss' figure of the dentition of *A. hortensis* also (l. c. pl. V., fig. 6) differs from my figure in the same way, *i. e.*, by the presence of an inner side cusp and cutting point to the lateral teeth. Thus I find it impossible to decide from the genitalia whether to refer our species to *fuscus* or *hortensis*, though I incline to the former. From the dentition I should assuredly adopt the former name also.

The jaw of the Boston specimen (pl. XVI., fig. 2) is thick, arcuate, ends but little attenuated; no median projection to the cutting edge: anterior surface with 8 stout, separated, unequal ribs, denticulating either margin.

Lingual membrane (pl. V., fig. 5) long and narrow. Teeth about 31—1—31, with about ten perfect laterals. Centrals with the base of attachment longer than wide: reflection half as long as the base of attachment, bearing one long, stout cusp extending to the lower margin of the base of attachment, beyond which projects the stout cutting point: side cusps distinct, but small, with distinct, small, stout cutting points. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower, lateral expansion of the base of attachment, and the inner side cusp and cutting point. The marginals are low, wide, with one long, bluntly pointed, oblique cutting point, bearing a subobsolete smaller point low down upon its outer side. This subobsolete side cutting point is on some of the marginals much more developed.

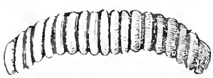
My figure *a* shows one central with its adjacent lateral, and *b* and *c* marginals, the latter form near the outer margin of the membrane.

From the above remarks it will be seen that in this genus, as in *Limax*, *Zonites*, and others, the lateral teeth are either bicuspid or tricuspid. The number of cusps does not seem a generic character.

Genus **ARIOLIMAX**, Mörch.

Jaw thick, slightly arcuate, ends but little attenuated, blunt; low, wide: anterior surface with numerous stout ribs, denticulating either margin. The number of ribs varies in the several species, and in different individuals of the same species. Fig. 39, drawn from the true northern *A. Columbianus*, has 18 ribs; another specimen, supposed to be the same species, has about 12. (See Proc. Ac. Nat. Sc. Phila. 1874, pl. II., fig. 11.) *A. Californicus* has given 13 and 14 ribs. *A. niger* has been described by Dr. Cooper with 20, but I found only 8 in one specimen which I refer to that species.

Fig. 39.



Jaw of *Ariolimax Columbianus*.

Fig. 498 of p. 279, L. and Frw. Shells N. A., I, gives the general arrangement of the teeth upon the lingual membrane. It is drawn from the true northern *A. Columbianus*. On pl. V., fig. 6, I have given more detailed figures of the dentition of a specimen I refer to this species. It will be seen that the central teeth have a base of attachment longer than wide, with expanded lower angles, and incurved lower margin; the upper margin is reflected; the reflection is large, broad, and has a short, stout median cusp, bearing a long, stout cutting point; the side cusps of the reflection are subobsolete, but there are well-developed triangular cutting points. The laterals are like the centrals, but unsymmetrical by the suppression of the inner lower lateral expansion to the base of attachment, and the inner side cutting point, the inner side cusps being still subobsolete.

The change from lateral to marginal teeth is shown in *b* and *c*, the median cusps and cutting point being greatly developed, and sometimes (*c*) having a side cusp and cutting point; the base of attachment is still narrower than in the first laterals. The marginals are shown in *d* and *e*. They are about as high as wide, the reflection equals the base of attachment and bears an extremely long, blunt, stout, oblique cutting point, with a side spur upon the last, in the extreme marginals developed into a short, stout, side cutting point. The cutting point of the marginals by its great development forms the chief characteristic of the membrane; it is well shown in profile (fig. *f*.). There were 22 perfect laterals in this specimen. The figure referred to above shows only 12 laterals, with 113 rows of 56—1—56 teeth each.

Ariolimax Californicus (pl. V., fig. 1) has the same type of dentition, but the bases of attachment are more developed, and are produced beyond the reflection at their upper margin. There are 80—1—80 teeth, with 9 perfect laterals.

Ariolimax niger, also (pl. V., fig. 3), has the same type of dentition as *A. Columbianus*, the side cusps of the centrals are, however, more developed. On one specimen I found marginal teeth with one inner stout, short, rounded cutting point, and two shorter, rounded, side cutting points (see fig. 2), instead of the usual long cutting point. This is the only variation in the dentition of the genus which I have noticed.

Since the above was written, I have received specimens which agree with Cooper's description of *Arion Andersoni*, which appear to be a true *Ariolimax*. Full descriptions will be given at another time. The jaw has 13 ribs. The lingual membrane has 48—1—48 teeth of the type usual in the genus.

Ariolimax Hemphilli, a species from Niles Station, Alameda County, California, which I am about to describe under the name of its discoverer, has a jaw with 8–12 ribs. Lingual membrane with 31—1—31 teeth of the type common to the genus.

For full remarks on this genus, see Proc. Ac. Nat. Sc. Phila. 1874, p. 33.

The genus, as far as now known, is restricted to this country; there are, therefore, no descriptions or figures of the jaw and dentition of foreign species to compare with ours.

Genus **PROPHYSAON**, Bl. and Binn.

Jaw of the single species known, *P. Hemphilli*, thick, low, wide, slightly arcuate, with but little attenuated ends, cutting margin without median projection; anterior surface with fifteen stout, irregularly developed, separated ribs, denticulating either margin (pl. XVI., fig. 9).

Lingual membrane (pl. V., fig. 4) long and narrow. Teeth about 40—1—40, with 16 perfect laterals. Centrals with a base of attachment longer than wide, reflection extending less than one-half the length of the base, with a very stout, short median cusp, bearing a stout, short, blunt cutting point, and on either side a subobsolete cusp bearing a stout, bluntly rounded, short cutting point. Laterals like the centrals, but unsymmetrical, as usual, by the suppression of the inner side cutting point and inner lower, lateral expansion of the base of attachment. Marginals (*b*) low, wide, with one inner, stout, oblique cutting point and two outer, smaller, blunt cutting points.

As in all lingual membranes, there is a difference in the development of the cusps and cutting points on various parts. The teeth figured are the least graceful in their outlines.

Genus **BINNEIA**, J. G. Coop.

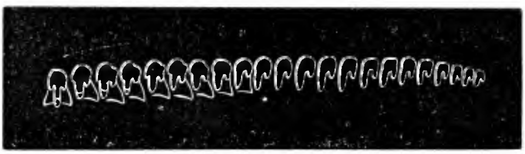
Jaw (fig. 40) low, arcuate, with blunt, scarcely attenuated ends; no median projections to the cutting edge; anterior surface with numerous, broad, crowded ribs.

Fig. 40.

Jaw of *Binneia notabilis.*

Lingual membrane (fig. 41) as usual in the *Helicinæ.* Centrals with a subquadrate base of attachment, with expanded lower angles; upper margin reflected; reflection large, bearing three distinct cusps, the central the longest; all three cusps apparently with distinct cutting points. Laterals like the centrals but unsymmetrical by the suppression of the inner cusp and cutting point, and

Fig. 41.



Lingual membrane of *Binneia notabilis.*

inner lower lateral expansion of the base of attachment. Marginals simply a modification of the centrals, subquadrate, higher than wide, with one inner, long, oblique, stout cutting point, and one outer, smaller, side cutting point.

I regret not being able to give a more satisfactory figure of the dentition of *B. notabilis*, our only known species.

It has 21—1—21 teeth, with 8 perfect laterals.

Genus **HEMPHILLIA**, Bl. and Binn.

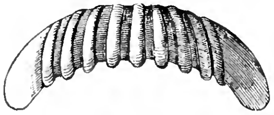
Jaw of the only known species, *H. glandulosa*, thick, low, wide, slightly arcuate, ends attenuated, blunt; cutting margin without median projection; anterior surface with about 14 crowded, stout, irregularly developed ribs, denticulating either margin (pl. XVI., fig. 6).

Lingual membrane (pl. V., fig. 7) long and narrow. Teeth 23—1—23, with 11 perfect laterals. Centrals with a quadrangular base of attachment, higher than wide. Reflection about half as long as this base, with a long, narrow median cusp reaching the lower margin of the base of attachment, beyond which projects slightly the short cutting point; side cusps but little developed, but bearing short, stout triangular cutting points. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the inner side cutting point. First marginal (*b*) with a square base of attachment, broadly reflected into one stout cusp, bearing a single, stout, very long, bluntly ending, oblique cutting point. Outer marginals (*c*) low, wide, the reflection broad, reaching the lower edge of the base of attachment, and bearing one inner, long, oblique, blunt cutting point; there appear no outer, small, side cutting points.

Genus PALLIFERA, Morse.

Jaw stout, arcuate, ends but little attenuated, blunt: anterior surface with stout separated ribs, 9 in *P. dorsalis* (fig. 42), over 15 in *P. Wetherbyi*. The jaw of the latter is arched, and has a blunt median projection, broken by the ends of the ribs. These last are more irregularly developed also.

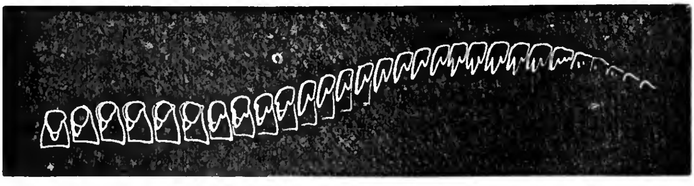
Fig. 42.



Jaw of *Tebennophorus dorsalis!*

Fig. 43 shows the arrangement of the teeth on the membrane in *P. dorsalis*, while separate teeth of the same species are more correctly drawn on pl. VI., fig. C.

Fig. 43.



Lingual dentition of *Pallifera dorsalis*.

Mr. Morse gives 115 rows of 56—1—56 teeth each, with 13 perfect laterals. In the specimen examined by me I found only 29—1—29 teeth, with 14 perfect laterals, a difference sufficiently great to raise a doubt of the specific identity of the two specimens. The central teeth have a base of attachment longer than wide, with short lines of reinforcement running parallel to the outer edges at the lower margin. The upper margin is reflected. The reflection extends about one-third of the length of the base of attachment; it bears a central, stout, well-developed cusp, and one small, little-developed, rounded cusp at each side; all three cusps have stout cutting points. The lateral teeth are like the centrals, but unsymmetrical by the suppression of the inner cusp and cutting point, and inner, lower, lateral expansion of the base of attachment. The marginal teeth are low, wide; broadly reflected, the reflection equalling the length of the base of attachment, and very irregularly denticulated, there being usually one long, blunt, oblique, inner, bifid cutting point, the outer division much the shorter, and several short, blunt, outer cutting points.

P. Wetherbyi (pl. VI., fig. B), the only other species now known, has 35—1—35 teeth, with 13 perfect laterals. The teeth are different from those of *P. dorsalis*, and nearer those of *Tebennophorus Caroliniensis*. The side cusps of the centrals and laterals are subobsolete, and have no distinct cutting points, the median cusp is much more produced, stouter, and bears a stout, blunt, cutting point. The marginal teeth are not so wide, they are less irregularly denticulated, having usually one long, stout, blunt, oblique, inner cutting point, and one shorter side cutting point.

Genus **HELIX**, Lin.

In common with all who have studied the genus *Helix*, I am convinced of the necessity of recognizing among its species numerous distinct genera. I have, however, at this time eliminated those species only whose jaw has no distinct ribs upon its anterior surface.[1] The balance of the species I retain grouped as subgenera[2] only. Before recognizing these groups as distinct genera, I desire to wait until we can ascertain whether generic characters

[1] I fear that even this rule will not hold good. In some subgenera of *Helix* the absence or presence of ribs on the jaw is not a reliable character. For instance, in *Dentellaria* we have found the jaw of *H. Josephinæ* and *formosa* without ribs. *H. dentiens*, *badia*, *pachygastra* are heavily ribbed. *H. lychnuchus*, *nucleola*, and *perplexa* less so.

[2] In the list of species given above (p. 152), I have used only the subgeneric names.

can be found in the jaws and lingual dentition as well as in the shells. I shall discuss the constancy of these characters under each group, as far as our material will allow. In this place I will merely mention that in general terms it may be said that *Pomatia*, *Tachea*, *Euparypha*, *Arionta*, and *Aglaja* have few, separated ribs, usually grouped near the centre of the jaw, leaving both extremities without ribs. *Mesodon*, *Triodopsis*, and *Polygyra* have numerous, separated ribs spread over the whole of the jaw. *Stenotrema* has numerous stout, crowded ribs also spread over the whole surface of the jaw. The ribs are also numerous, crowded, and similarly disposed in *Strobila*, *Gonostoma*, *Dorcasia*, and *Fruticicola*, but they do not so deeply denticulate both margins as in the genera mentioned above. All the above have a high jaw. The following have a much lower jaw: *Vallonia*, with numerous crowded ribs slightly denticulating the margins, especially the lower one; *Acanthinula*, with similar ribs, but quite arched; *Glyptostoma*, with still more numerous, separated ribs, deeply denticulating either margin; and *Polygyrella*, with more numerous ribs, and proportionally much wider to its height than in any of the other North American subgenera. Thus there seems to be some distinctive subgeneric character to the jaw. It must, however, be borne in mind that there are exceptions in some of the subgenera where the species are numerous; thus, in *Arionta*, I found numerous ribs in *ruficincta*, though the other species have but few. The number, disposition, and size of the ribs vary within certain limits in different individuals of the same species. I have repeatedly found this to be the case.

In regard to the subgeneric value of the type of lingual dentition, I can only say in general terms that within certain limits it may prove reliable. Here again, however, we find the type of dentition inconstant when many species are known. Thus in *Arionta* we find *Townsendiana* (pl. XVIII., fig. 8) quite differing from the other known species (see below). In *Mesodon*, also (pl. XII.), I find two quite distinct types of dentition, and under each subgenus I have pointed out the variation observed. I am convinced that the presence or absence of side cusps to central and lateral teeth is not a reliable subgeneric character. The marginal teeth offer more reliable characters. They are very peculiar in *Vallonia* and *Strobila*, in being very low and wide, and having numerous cutting points, quite resembling those of *Pupa*.

In *Mesodon*, *Triodopsis*, and *Arionta*, the marginals are longer than wide, with only two, sometimes bifid cutting points. In *Stenotrema* and *Polygyra* they are rather wider than long, also with two more bluntly bifid cutting points. It must be borne in mind, however, that my observations have not led me to believe these characters sufficiently constant to be of subgeneric value. I prefer to wait till more species have been examined. There is also some variation in the mode of passing from lateral to marginal teeth, even in the same subgenus. These points will be treated more fully under each subgenus.

Subgenus Gonostoma.

This subgenus is represented in our limits by one species only, *H. Yatesi*, J. G. Cooper, not Pfr., whose jaw and lingual membrane are here described. Jaw (pl. XVI., fig. 10) low, wide, slightly arcuate, ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with a strong transverse line of reinforcement, and numerous, about 12, wide, crowded ribs denticulating either margin.

Lingual membrane (pl. IX., fig. 3) long and narrow; teeth 24—1—24, with 6 perfect laterals. Centrals with the base of attachment longer than wide, with expanding lower lateral angles, and squarely reflected upper margin; reflection large, stout, bearing small but distinct side cusps, with short, blunt cutting points, and a long, stout, median cusp reaching the lower edge of the base of attachment, beyond which projects the long, acute cutting point. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the distinct inner side cusp and cutting point. Marginals subquadrate (*b*), a simple modification of the laterals, the reflection being more developed, and bearing one inner, oblique, long, blunt cutting point, and one smaller side cutting point; the extreme marginals (*c*) are rather wider than high, and the cutting points are bluntly rounded.

The name *Yatesi* being already preoccupied in the genus *Helix*, Dr. Cooper's species may be known as *Yatesiana*.

Von Martens describes the jaw of *Gonostoma* as having distinct ribs. Moquin-Tandon so figures that of *obvoluta*, Müll, *lenticula*, Fér, and *Rangiana*, Fér; and Gassies (Journ. de Conch., XV., 1867, 15) so describes that of *H. constricta*, B.

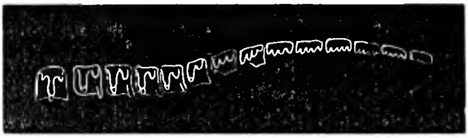
The lingual membrane of *obvoluta* is described by Goldfuss (l. c. 45) with a type of central teeth differing from that I have shown in *Yatesi.*

Subgenus Strobila.

Jaw low, wide, slightly arcuate, ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with (over 12 in *labyrinthica*, numerous in *Hubbardi*) crowded ribs, denticulating either margin, and more developed on the centre of the jaw.

Lingual membrane of *labyrinthica* long and narrow, with 78 rows of 13—1—13 teeth each, with 5 perfect laterals. Morse

Fig. 44.



Lingual dentition of *Helix labyrinthica.* [Morse.]

figures 6 laterals. Centrals with a base of attachment about square, upper edge broadly reflected; reflection very short, bearing a long, slender, median cusp reaching the lower edge of the base of attachment, with a short cutting point extending slightly beyond it; side cusps very small, each bearing a short cutting point. Lateral teeth like the centrals, but unsymmetrical by the suppression of the inner lower angle of the base of attachment, and the inner side cusp and side cutting point. Outer laterals gradually changing into the marginals, which are low, wide, with a reflection equalling the base of attachment, and furnished with numerous (about 5) subequal, short cutting points, the inner one longest and bifid (pl. XVIII, fig. 7).

Morse mentions no ribs on the anterior surface of the jaw, but they are well developed on the specimen examined by me.

Helix Hubbardi, a specimen from Bonaventure Cemetery near Savannah, kindly opened by Mr. Bland, furnished a jaw and lingual membrane. Jaw long, low, slightly arcuate, ends acuminated; no median projection to cutting edge; anterior surface with numerous crowded ribs, denticulating either margin.

Lingual membrane with 14—1—14 teeth, 5 laterals. All the teeth like those of *H. labyrinthica* (pl. XVIII., fig. 11).

There are no known species foreign to North America, with which to compare the dentition and jaw of *labyrinthica* and *Hubbardi*.

Subgenus Polygyra.

Fig. 45.

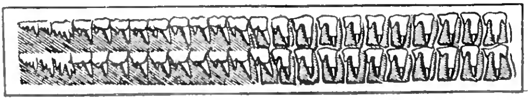
Jaw of *Helix ventrosula*.

Jaw high, arcuate, ends scarcely attenuated, blunt, cutting edge without median projection; anterior surface with numerous stout, separated ribs, denticulating either margin. I have counted 8 ribs in *H. ventrosula;* 14 in *pustula;* over 14 in *cereolus;* 10 in *espiloca;* 13 in *uvulifera;* 10 in Texasiana; 12 in *Troostiana;* 11 in *leporina;* 15 in *Mooreana;* 20 in *fastigans;* 7 in *septemvolva;* 10 in *Febigeri;* in *Hazardi*, *auriculata*, and *auriformis* they are also numerous. I have had no opportunity of examining the jaw in the other species found within our limits, *Postelliana*, *avara*, *Hindsi*, *triodontoides*, *tholus*, *hippocrepis*, *oppilata*, *Dorfeuilliana*, *Ariadnæ*, *cereolus* (see p. 203), *Carpenteriana* (see ib.), *pustuloides*.

By the character of its jaw, *Polygyra* can be compared only to *Triodopsis* and *Mesodon* among the other North American subgenera of *Helix*. No foreign species has yet been examined. The genus is almost exclusively North American, though several species have been described from the West Indies and Mexico, and one from Bolivia.

Fig. 46 shows the general arrangement of the teeth upon the

Fig. 46.



Lingual dentition of *Helix auriformis?* [Leidy.]

lingual membrane, the characters of the individual teeth being better shown in my plate VIII. The teeth do not differ from what I have described under *Stenotrema* (see p. 205). As in all the subgenera, there is considerable difference in the length of the base of attachment on the central and lateral teeth in the several species.

The marginals are lower and wider (see pl. VIII., fig. 1, *d*) than in *Mesodon* and *Triodopsis*, but this character is not constant, the marginals of *auriculata* and *auriformis* being higher than wide. I find considerable difference also between the various species in the manner in which the lateral teeth pass into the marginals. In *auriformis*, *espiloca* and *Hazardi*, the change is made simply by the greater development of the inner cutting point, not by its bifurcation (see pl. VIII., fig. 5, *b*). In these species it is only the extreme outer marginals that have their inner cutting point bifid; in *H. auriformis* a very few extreme marginals have a bifid cutting point. This species and *H. auriculata* have very long inner cutting points to their marginal teeth (see fig. 9, *c* of pl. VIII.). In the other species examined by me the first marginals have their inner cutting point bifid, the transition from laterals to marginals being thus very distinctly marked. With these exceptions, the dentition of our species of *Polygyra* is very like that of *Stenotrema* (q. v.).

The dentition of no foreign species is known with which to compare our species.

The count of the teeth in the various species now follows:—

H. auriculata (pl. VIII., fig. 12) has 27—1—27 teeth with 12 laterals, 10 ribs on jaw.

H. uvulifera (pl. VIII., fig.) 23—1—23 with 8 laterals.

H. auriformis (pl. VIII., fig. 9) has 26—1—26 teeth, with 8 laterals. Fig. *c* shows the proportional greater development of the cutting point in the outer laterals.

H. Postelliana, Bland. Not examined.

H. espiloca, Rav. (pl. VIII., fig. 4) has 25—1—25 with 11 laterals.

H. avara. Not examined.

H. ventrosula (see L. and Frw. Shells N. A. I. p. 92, fig. 166), 93 rows of 24—1—24 with 9 laterals. I have not preserved this membrane, so cannot now correctly draw it.

H. Hindsi. Not examined.

H. Texasiana (pl. VIII., fig. 1) has 26—1—26 with 11 laterals.

H. triodontoides. Not examined.

H. Mooreana (pl. VIII., fig. 10) has 20—1—20 with 8 laterals.

H. tholus. Not examined.

H. hippocrepis. Not examined.

H. fastigans (pl. VIII., fig. 11) has 21—1—21 with 8 laterals.

H. Jacksoni. Not examined.

H. Troostiana (pl. VIII., fig. 2) has 25—1—25 teeth with 8 laterals. The marginals figured are from the portion of the membrane where they are the least developed as to their cutting points.

H. Hazardi (pl. VIII., fig. 5) has 16—1—16 teeth with 8 laterals.

H. oppilata. Not examined.

H. Dorfeuilliana. Not examined.

H. Ariadnæ. Not examined.

H. septemvolva (pl. VIII., fig. 6) has 9 laterals. I cannot count the teeth or draw the marginals on the only slide I have preserved. The latter were described by me as being like those of *fastigans.* After an opportunity of examining the true *septemvolva* at St. Augustine, I give a more detailed figure on pl. XX., fig. 5. There are 28—1—28 with 9 laterals. The small form with five whorls differs only in having somewhat fewer teeth. The form known as *H. volvoxis* does not differ excepting in having fewer marginals: Jacksonville, Fla., specimens have 20—1—20 teeth.

H. cereolus. Too late for illustration, I have received specimens collected at Key West by Mr. W. W. Calkins. There are 22—1—22 teeth, with 9 laterals all of same type as in *septemvolva.* 14 ribs on jaw.

H. Carpenteriana. 22—1—22 teeth, with 9 laterals, 12 ribs on jaw.

H. Febigeri (pl. VIII., fig. 7) has 17—1—17 teeth with 9 laterals.

H. pustula (pl. VIII., fig. 8) has 17—1—17 teeth with 8 laterals.

H. pustuloides. Not examined.

H. leporina. Too late for inserting in the plates, I have received through Mr. Bland, the jaw and lingual membrane of a Texas specimen furnished by Mr. A. G. Wetherby. The jaw has 11 ribs. There are 18—1—18 teeth, with 8 laterals, all of same type as in *H. fastigans.*

Subgenus Polygyrella.

Jaw of the only known species, *Helix polygyrella* (pl. XVI., fig. 11) very low, wide, very slightly arcuate, ends very gradually attenuated: cutting margin without median projection: anterior surface with numerous (even 26), broad, slightly separated ribs, denticulating either margin.

Lingual membrane (pl. IX., fig. 2) long and narrow. Teeth 27—1—27, with 5 perfect laterals. Centrals subquadrate, the lower lateral angles but little expanded; the upper margin broadly reflected: reflection large, wide, with distinct, but small, rounded side cusps bearing short conical cutting points, and a very stout median cusp reaching the lower margin of the base of attachment, beyond which projects the short, stout, conical cutting point. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower angle of the base of attachment, and the inner side cusp and cutting point. First marginals a simple modification of the laterals by the lesser development of the cutting point (*b*). Outer marginals (*c*) low, wide, the reflection equalling the base of attachment and bearing one inner, short, stout, oblique cutting point, and two shorter outer blunt cutting points.

Polygyrella is quite distinct from all the other American subgenera of *Helix* by the form of its jaw and the large number of ribs upon its anterior surface.

Subgenus Stenotrema.

Jaw thick, high, arched; ends but little acuminated, blunt; cutting margin without median projection; anterior surface with stout, broad, crowded ribs, denticulating either margin. There are about 8 in *stenotrema*, 11 in *germana*,[1] 7 in *monodon*, 8 in *hirsuta*, 13 in *Edvardsi*, 12 in *barbigera*, 8 in *spinosa*.

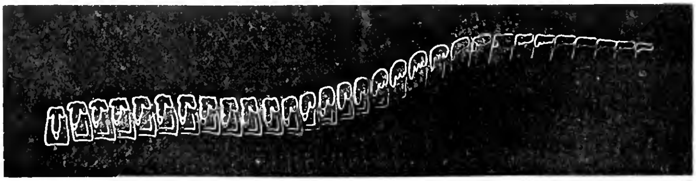
Fig. 47.

Jaw of *Helix monodon*. [Morse.]

I have had no opportunity of examining *H. labrosa*, *Edgariana*, or *maxillata*.

The subgenus is restricted to North America as far as known. It differs from our other subgenera in having its ribs much broader and much more closely crowded.

Fig. 48.



Lingual dentition of *Helix monodon*. [Morse.]

Fig. 48, drawn by Mr. Morse, gives the general arrangement of the teeth on the lingual membrane. The characters of the individual teeth are more correctly shown in my figures on pl. IX.

[1] See Ann. Lyc. N. H. N. Y., X. pl. XIV., fig. 4. Perhaps a *Mesodon*.

Centrals with a base of attachment longer than wide, the lower lateral angles but little expanded, the lower margin incurved, the upper margin squarely reflected; reflection large, wide, with small, in some species almost obsolete, side cusps, always bearing distinct, well developed cutting points; and a very stout median cusp, bearing a stout cutting point which usually projects beyond the lower edge of the base of attachment. Laterals like the centrals, but unsymmetrical by the suppression of the inner lateral angle of the lower edge of the base of attachment and the inner side cusp and cutting point. The transition from laterals to marginals is shown in pl. IX., fig. 8 (*H. spinosa*). It is, as usual, produced by the comparative lesser development of the inner cusp and greater development of its cutting point. This cutting point becomes bifid, the reflection becomes shorter, the cutting points more produced, and thus gradually the form of the marginal teeth is reached. They are low, wide, the reflection equalling the base of attachment, the cutting points long, oblique, usually two in number, the inner one generally, and the outer one rarely, bluntly bifid: the outer bifurcation of each is more produced than the inner. There is great variation in the denticulation of the marginal teeth even on the same lingual membrane. A transition from laterals to marginals similar to that of *H. spinosa* is found in *H. barbigera*, *Edvardsi*, *stenotrema*, *hirsuta*, *germana*, and *monodon*.

There seems no difference in the characters of the teeth of the different species examined by me, excepting the slight one of the greater or lesser development of the side cusps of centrals and laterals, especially the former; whether this is constant can only be proved by a careful examination of every portion of each lingual. In *H. hirsuta* I found these cusps more developed than in the other species (pl. IX., fig. 6).

The count of the teeth in the different species is as follows:—

H. spinosa (pl. IX., fig. 8) has 27—1—27 teeth; 9 perfect laterals.

H. Edvardsi (pl. IX., fig. 1) has 20—1—20 teeth; 9 perfect laterals.

H. barbigera (pl. IX., fig. 9) has 21—1—21 teeth; 8 perfect laterals; but even the third has its inner cutting point greatly produced.

H. stenotrema (pl. IX., fig. 7) has 20—1—20 teeth; 10 perfect laterals.

H. hirsuta (pl. IX., fig. 6) has 22—1—22 teeth; 10 perfect laterals.

H. germana (pl. IX., fig. 5) has 28—1—28 teeth; 12 perfect laterals. Fig. 6 shows one of the few marginals which have the outer cusp bifid.

H. monodon (pl. IX., fig. 4) has 21—1—21 teeth; 10 perfect laterals. Morse gives 28—1—28 teeth.

H. labrosa, *maxillata*, and *Edgariana* not examined by me.

Subgenus Triodopsis.

Fig. 49.

Jaw of *Helix appressa*.

Jaw stout, arcuate, low, wide, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous decided, separated ribs, denticulating either margin. There are about 15 in *palliata;* 10 in *obstricta;* 15 in *appressa;* 14 in *inflecta;* 10 in *Rugeli;* 14 in *fallax;* over 10 in *Hopetonensis;* over 12 in *Harfordiana;* 11 in *loricata;*[1] over 10 in *tridentata*. I have not examined *H. Mullani*[2] and *vultuosa*.

The subgenus is almost exclusively North American. Two Central American species have, however, been described, and one European species, *H. personata*, Lam. This last is said by Moquin-Tandon to have 3—5 separated ribs upon its jaw, while our American species, as shown above, have numerous ribs.

Triodopsis does not differ from *Mesodon* or *Polygyra* in the character of its jaw. *Stenotrema*, on the other hand, is readily distinguished by having the ribs broader and more crowded on its jaw.

Fig. 50.

Lingual dentition of *Helix appressa*.

The general arrangement of the teeth on the lingual membrane is shown in fig. 50. The characters of the individual teeth are given on pl X. I have selected *H. appressa* (fig. 7) to show these

[1] The ribs are more crowded in this species.

[2] Probably identical with *devia*.

characters, comparing the dentition of the other species with it. The centrals are longer than wide; the base of attachment has its outer, lower, lateral expansion but little developed, its lower margin incurved, its upper margin squarely reflected; the reflection is stout, with subobsolete side cusps, but well-developed side cutting points, and a stout, short median cusp, bearing a cutting point which does not reach the lower margin of the base of attachment. The laterals are like the centrals, but, as usual in the genus *Helix*, unsymmetrical by the suppression of the inner, lower, lateral expansion of the base of attachment and the inner side cusp with its cutting point. The transition teeth are characterized by the gradual lesser proportional development of the reflection, and greater development of the inner cutting point; as the teeth pass outward, this point becomes bifid, the reflection becomes gradually shorter, until the true marginals are reached. These last are low, wide, the reflection equalling the base of attachment, the inner cutting point being greatly developed, long, oblique, bluntly bifid, the inner bifurcation the shorter of the two; the outer cusp is very short, blunt, sometimes also bifid. In fig. 7, the 10th is the first lateral showing decided modification; the 14th tooth has its inner point bifid; the 17th tooth is a decided marginal. The transition from laterals to marginals is so gradual that it is often difficult to give the number of perfect laterals. In many cases, therefore, the number given by me must be considered as only approximately correct. There is great variation in the denticulation of the marginal teeth.

The general character of the dentition of the other species is about the same as in *appressa*. I found great difficulty in detecting the side cutting points in several species, especially *tridentata* and *palliata*. In some species I did not find the transition teeth or inner marginals with bifid cutting point (pl. X., fig. 3, 4).

I give below the count of the teeth in the several species.

H. palliata (pl. X., fig. 2) has 34—1—34 teeth; 12 perfect laterals; another specimen had 14 laterals. Morse counted 115 rows of teeth. The inner cutting point of the transition teeth in this species is very large, as shown in *c*.

H. obstricta (pl. XVIII., fig. 10) has 33—1—33 teeth; 10 perfect laterals: very like *H. palliata*. My figures are drawn from that part of the lingual membrane which has the cutting points of its teeth quite blunt. Other portions of the membrane would furnish much more sharply pointed teeth.

H. appressa (pl. X., fig. 7) has 33—1—33 teeth; about 12 perfect laterals.

H. inflecta (pl. X., fig. 4) has 22—1—22 teeth ; 7 perfect laterals. This and the following species have inner marginal teeth with simple, not bifid, cutting points (*c*).

H. Rugeli (pl. X., fig. 3) has 21—1—21 teeth ; 6 perfect laterals.

H. tridentata (pl. X., fig. 1) has 25—1—25 teeth; 10 perfect laterals. The inner cutting point is bifid after the 10th.

H. Mullani. The species is probably identical with *devia.*

H. Harfordiana has 26—1—26, with 12 laterals. Jaw with over 12 ribs. Received too late for illustration.

H. fallax (pl. X., fig. 5) has about 40—1—40 teeth; 14 laterals. This (not *tridentata*) had no bifurcation to the inner cutting point of the transition teeth, at least on the portion of the membrane examined by me.

H. introferens not examined by me.

H. Hopetonensis (pl. X., fig. 6) has 27—1—27 teeth as far as I can judge from an imperfect membrane. There are 7 perfect laterals.

H. vultuosa, not examined.

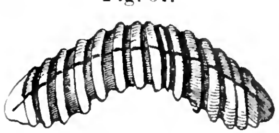
H. loricata (pl. XVIII., fig. 4) has over 20—1—20 teeth; 8 perfect laterals.

Helix personata is the only European species of this subgenus, but no figure of its dentition has been published to compare with that of our species. The same is true of the two Central American species known.

Subgenus Mesodon.

Jaw stout, high, arcuate, wide, ends but little attenuated, blunt; no median projection to the cutting margin; anterior surface with numerous, separated, decided ribs, denticulating either margin. I have counted 13 in *H. major;* 10 in *albolabris;* 10 in *multilineata;* 11 in *Pennsylvanica;* 12 in *Mitchelliana;* 12 in *elevata;* 13 in *Clarki;* 13 in *exoleta:* 18 in *Wetherbyi:* 14 in *dentifera;*

Fig. 51.



Jaw of *Helix Sayii.* [Morse.]

7 in *Roëmeri:* 13 in *thyroides:* 10 in *clausa:* 8 in *Columbiana:*[1] 7 in *devia:* 10 in *profunda:* 15 in *Sayii:* 10 in *Mobiliana:* over 10 in *Downieana.*

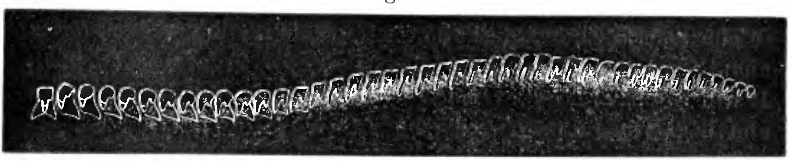
I have had no opportunity of examining *H. divesta*, *Christyi*, *Wheatleyi*, and *jejuna*.

Nothing has been published regarding the jaw and lingual dentition of the subgenus from species foreign to North America, as it is exclusively confined to this country.

The jaw of *Mesodon* does not essentially differ from that of *Triodopsis* and *Polygyra*, but may readily be distinguished from that of the other American subgenera.

The lingual membrane is long and narrow. The general arrangement of the teeth is shown in fig. 52. The characters of the

Fig. 52.



Lingual dentition of *Helix multilineata*.

individual teeth are better shown in my plates. It will be seen that there are two distinct types of dentition among the species of the subgenus. The first form of dentition is found in *albolabris* (pl. XI., fig. 1), *Roëmeri* (pl. XI., fig, 3), *Wetherbyi* (pl. XI., fig. 2), *Downieana* (pl. XI., fig. 4), *Sayii* (pl. XI., fig. 5) *exoleta* (pl. XI., fig. 7), *Pennsylvanica* (pl. XVIII., fig. 3), *Mitchelliana* (pl. XVIII., fig. 5), *elevata* (pl. XII., fig. 1), *Columbiana* (pl. XII., fig. 2), *Mobiliana* (pl. XII., fig. 3), *devia* (pl. XII., fig. 4), *profunda* (pl. XII., fig. 5) *multilineata* (pl. XII., fig. 6), *dentifera* (pl. XII., fig. 8), *Clarki* (pl. XI., fig. 6). Even among these species there are some important variations. Thus I have failed to detect any side cutting points on the subobsolete side cusps of the central and first lateral teeth of *Roëmeri*, *Wetherbyi*, *Downieana*, *Sayii*, *exoleta*, *Pennsylvanica*, and *Mitchelliana*. All these species have their side cusp less developed than in the other species mentioned above. The presence of the cutting point may be detected by better manipulation than I am able to give, but as far as my powers

[1] See Ann. N. Y. Lyc. of N. H., X. pl. XIV., fig. 2.

go, I cannot find it. The outer laterals, however, in most of the species have a much more developed side cusp than the inner laterals, bearing a well-developed cutting point (see pl. XI., fig. 6, *d*), but not all the species, as *H. exoleta* for instance, as shown in pl. XI., fig. 7, *d*, has no well developed side cusp and cutting point on its outer laterals, nor does it appear except on the decided marginals. It is the same in *H. Sayii.*

I find also variation in the manner of passing from the lateral to the marginal teeth among the species of this first group of *Mesodon.* In *H. exoleta* (pl. XI., fig. 7, 14) the cutting point remains the same, and also in *Sayii*, *profunda*, *Wetherbyi*, and *Mitchelliana*, but in *elevata* (pl. XII., fig. 1, 18) the transition teeth are characterized by the bifurcation of the large cutting point; the same occurs in *albolabris*, *multilineata*, *Roëmeri*, *Columbiana* (pl. XII., fig. 2) and *devia*, and the rest of the group.

The general character of the teeth in this section of *Mesodon* is about the same as I have described above for *Triodopsis* (p. 260). It will be noticed, however, that the marginals (as in *H. exoleta* and *Wetherbyi*) do not always have their cutting points bifid.

The other type of dentition in the subgenus *Mesodon* is shared by *H. thyroides* (pl. XVIII., fig. 2), *clausa* (pl. XII., fig. 7), and *Wheatleyi* (pl. XVIII., fig. 1). The centrals and first laterals have subobsolete side cusps without cutting points, the outer laterals have no side cusp, but retain the type of the first laterals, they are much longer, narrower, and have one extremely long, oblique, stout, bluntly pointed cutting point, reaching far beyond the lower margin of the base of attachment. These outer laterals pass gradually into the marginals, which retain their general form but have a less developed reflection, and much more proportionally developed cutting point, sometimes bifid in the extreme marginals (pl. XVIII., fig. 2, 54), and usually with a small side cutting point.

As in all the subgenera of *Helix*, the marginal teeth of *Mesodon* show great variation in their denticulation, even in most cases on the same membrane. *H. Clarki* (pl. XI., fig. 6) has the marginals with cutting points much blunter and broader in some parts than in the others.

The study of the dentition of *Mesodon* shows that we must be prepared to find considerable variation in the character of the teeth of any subgenus. The peculiar outer lateral teeth and marginals of *H. thyroides*, for instance, would hardly have been expected, so utterly different are they from those of *albolabris*. Again, we should hardly have expected to find such a difference in the same subgenus, as the presence and absence of side cutting points on the central and first lateral teeth.

I will now give the count of teeth in the several species.

Helix major, not examined.

Helix albolabris (pl. XI., fig. 1). Outer laterals have distinct side cusps as well as cutting points. Teeth 44—1—44, with about 12 laterals. The inner cutting points of fig. *b* should be bifid.

Helix divesta, not examined.

Helix multilineata (pl. XII., fig. 6), 42—1—42; 12 laterals.

Helix Pennsylvanica (pl. XVIII., fig. 3), 40—1—40; 13 perfect laterals. Morse counted 120 rows of 39—1—39 teeth.

Helix Mitchelliana (pl. XVIII., fig. 5), 49—1—49; 18 laterals. Outer laterals have side cusps and cutting points.

Helix elevata (pl. XII., fig. 1), about 45—1—45; 17 laterals.

Helix Clarki (pl. XI., fig. 6), 35—1—35, with 15 laterals.

Helix Christyi, not examined.

Helix exoleta (pl. XI., fig. 7) has 56—1—56; 11 perfect laterals, but even the 8th tooth shows a decided modification in form.

Helix Wetherbyi (pl. XI., fig. 2) has 35—1—35; 12 laterals.

Helix Wheatleyi (pl. XVIII., fig. 1) has 67—1—67, with over 12 laterals.

Helix dentifera (pl. XII., fig. 8) has 32—1—32 teeth, with 15 laterals.

Helix Roëmeri (pl. XI., fig. 3) has 35—1—35 teeth, with 12 laterals.

Helix thyroides (pl. XVIII., fig. 2) has 60—1—60, with 11 laterals.

Helix clausa (pl. XII., fig. 7) has 41—1—41, with about 11 perfect laterals.

Helix Columbiana (pl. XII., fig. 2) has 33—1—33 teeth; 15 perfect laterals.

Helix Downieana (pl. XI., fig. 4) has 35—1—35 teeth, with 12 laterals. The side cusps and cutting points are visible on the second lateral tooth.

Helix Lawi, not observed.

Helix Mobiliana. The true species, from Baldwin County, Alabama, Dr. E. R. Showalter (pl. XII., fig. 3). There are 25—1—25 teeth, with 10 perfect laterals.

Helix jejuna, not examined.

Helix devia (pl. XII., fig. 4) has 23—1—23, with 16 perfect laterals.

Helix profunda (pl. XII., fig. 5) has 40—1—40 teeth, with about 14 perfect laterals.

Helix Sayii (pl. XI., fig. 5) has 42—1—42 teeth, with about 15 perfect laterals.

Subgenus Acanthinula.

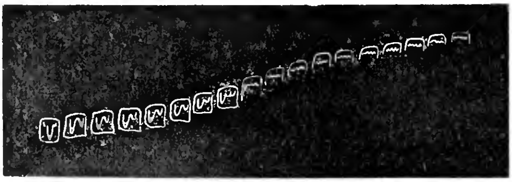
We have but one species within our limits, *H. harpa*, whose jaw and lingual dentition have been described and figured by Morse. Judging from his figure (fig. 53) and text, the anterior surface of the jaw seems to have subobsolete ribs which mark the lower margin; it is low, wide, strongly arched, with blunt, scarcely attenuated ends; cutting edge with a wide and very slightly produced, broad median projection; transversely and longitudinally striate.

Fig. 53.

Jaw of *Helix harpa*. [Morse.]

Lingual membrane long and narrow, 120 rows of 17—1—17 teeth, with 6 perfect laterals. The centrals have a square base of

Fig. 54.



Lingual dentition of *Helix harpa*. [Morse.]

attachment, the upper margin squarely reflected; the reflection is very small, tricuspid, the side cusps very small, blunt, the median cusps very long and narrow, not reaching the lower edge of the base of attachment, not even with its short cutting point; side cusps also, I presume, with cutting points, though none are shown in Morse's figure. Laterals like the centrals, but unsymmetrical by the suppression of the inner side cusps, and cutting points.

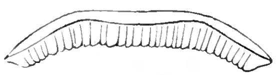
Marginals low, wide, the broad reflection equalling the base of attachment and irregularly denticulated, as in *Pupa*.

There are two European species of this subgenus, *H. aculeata* and *lamellata*, whose jaw is described by Lehmann as rather striated than ribbed. Their lingual dentition presents no subgeneric differences from that of *harpa*, though the cusps of the centrals are described as simply conical.

Subgenus VALLONIA.

Jaw low, wide, slightly arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous crowded, broad ribs, denticulating the lower margin. (Fig. 55.)

Fig. 55.



Jaw of *Helix pulchella*. [Morse.]

Lingual membrane (pl. XVIII., fig. 6) long and narrow. Morse gives 73 rows of 11—1—11 teeth, with 3 perfect laterals. I counted 10—1—10, with 3 perfect laterals. Centrals with the base of attachment long and narrow, expanded and notched at the outer lower angles, narrowed above and reflected; reflection very small, tricuspid, all the cusps bearing very short cutting points, the central one, as usual, longest. Laterals with the base of attachment twice as broad as in the centrals, the inner lower angle suppressed, notched at the outer angle, broadly reflected above; reflection larger than in the centrals, with one inner, long, slender cusp, reaching nearly the lower edge of the base of attachment, its cutting point quite reaching it, and one small outer side cusp, also bearing a distinct cutting point. Marginals low, wide, the reflection equalling the base of attachment and irregularly denticulated along its edge, the inner cusp the longest and bifid. The dentition is quite that of *Pupa*.

Fig. 56.

Lingual dentition of *Helix pulchella*. [Morse]

The above description is drawn from a specimen from Maine. The European form is figured by Moquin-Tandon with a median projection to the cutting edge of its jaw. Lehmann also figures a wide, slight projection to the cutting edge. A comparison of the description and figure of the dentition of the European specimens given by Thomson and Lehmann shows no specific difference. It will be noticed that Lehmann's figure of the centrals shows a more developed reflection and cusp and no side cusps. I believe, however, that careful comparison will show no variation in this or other particulars.

Subgenus FRUTICICOLA.

The two species of this subgenus found within our limits, *H. rufescens* and *H. hispida*, are purely local, having been introduced by commerce at Quebec and Halifax, respectively. I have not had an opportunity of examining either. The jaw of the subgenus is described as arcuate with blunt ends; anterior surface with broad, crowded ribs (see figure of that of *hispida* copied from Moquin-Tandon); Lehmann (l. c., pl. XII., fig. 57) figures the lingual membrane of *hispida* with centrals having a long narrow base of attachment, a stout, pear-shaped, unicuspid reflection; laterals bicuspid, marginals a simple modification of the laterals. Other species are also figured by Lehmann.

Fig. 57.

Jaw of *Helix hispida*.

Subgenus DORCASIA.

I hesitate to place our two species, *H. Berlandieriana* and *griseola* in this subgenus on account of the geographical range of its species. I will, however, temporarily leave them here. I do not believe they properly belong to *Fruticicola*.

I have not examined *H. Berlandieriana*. The other species, *griseola*, has a jaw (pl. XVI., fig. 14) slightly arcuate; high, ends scarcely *attenuated*, blunt; cutting margin without median projection; anterior surface entirely covered with numerous, about 12, broad, crowded ribs, denticulating either margin.

Lingual membrane (pl. XIII., fig. 2.) long and narrow. Teeth about 27—1—27, with 12 perfect laterals. Centrals with the base of attachment long and rather narrow, the outer lower angles but little expanded, the upper margin broadly reflected; reflection large, with a very stout, long median cusp, bearing a long, stout cutting point extending below the lower edge of the base of attachment, side cusps obsolete, but side cutting points present, large, triangular, acute. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower lateral angle of the base of attachment and inner side cutting point. Marginals (*b*) low, wide, the reflection broad, equalling the base of attachment and bearing one inner, broad, long, oblique, bifid cutting point, the inner division the smaller, and two outer, smaller, stout, sharp, side cutting points.

Subgenus AGLAJA.

Jaw thick, high, arched, ends but little attenuated, blunt; cutting edge without median projection; anterior surface with stout, separated ribs, denticulating either margin, from 5 to 9 in *H. infumata* (fig. 58), about 6 in *fidelis*. The other American species, *H. Hillebrandi*, I have not examined.

Fig. 58.

Jaw of *Helix infumata.*

Lingual membrane long and narrow. That of *Hillebrandi* not examined, those of *infumata* and *fidelis* agreeing in their general characters. The centrals have a base of attachment longer than wide, with incurved lower margin and expanded lower lateral angles; upper margin broadly reflected; reflection short, stout, with no side cusps or cutting points, but a very stout, short median cusp, bearing a short cutting point. Laterals like the centrals, but unsymmetrical by the base of attachment wanting the inner, lower lateral expansion; it is, however, unusually developed on its inner side margin: first marginals (*b* of each figure) differing from the laterals by the equalling of the reflection and base of attachment, the lesser development of the cusp, and greater development of the cutting point, which is bluntly bifid, the inner division the smaller. On some of the first marginals of *infumata* (pl. XIII., fig. 9, *b*) there is a small side cutting point. Marginals low, wide, the reflection equalling the base of attachment, and bearing one long, oblique, wide, bifid cutting point, the inner division the smaller, and one or two short, sharp, side cutting points. There is great variation in the cutting points.

A comparison of the two figures will show a longer base of attachment in *fidelis*, with a line of reënforcement or duplication to its upper margin. As with all species, there is much variation in the length of the cutting point, in centrals and laterals, and their arrangement and development in the marginals.

H. fidelis (pl. XIII., fig. 8) has 48—1—48 teeth, with 15 perfect laterals. The first marginal is shown in *b*, an outer marginal in *c*. Usually the first marginals have a side cutting point.

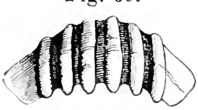
H. infumata (pl. XIII., fig. 9) has 45—1—45 teeth, with 16 laterals. Fig. *b* is the 17th tooth, from a different portion of the membrane from *c*, which is the 20th; they show variation in the transition teeth as to the presence of the side cutting point. Extreme marginals are shown in *d*.

Of the dentition of the other species of *Aglaja* foreign to our limits but little is known. *H. Ghiesbreghti* (see Moll. Mex. et Guat.) has very dissimilar teeth, especially the marginals. *H. semiclausa* (Malak. Blak. XV., pl. IV., fig. 4) also differs in its dentition. The jaws of these species agree with those of *infumata* and *fidelis*.

Subgenus Arionta.

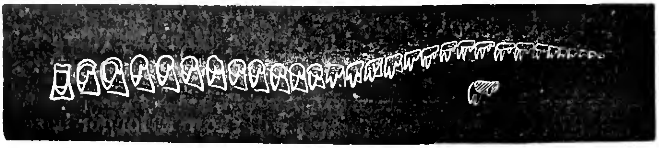
Jaw thick, high, arched, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with a few, separated, stout ribs, deeply denticulating either margin, and so disposed as to leave each end of the jaw free from ribs. I have counted 6 ribs on the jaw of *arrosa;* 9 in *Townsendiana;* 6 in *tudiculata;* 6 in *Nickliniana;* 6 in *redimita*; 6 in *exarata;* 5 in *Diabloensis;* about 7 in *Carpenteri;* 3 in *ramentosa;* 5 in *Californiensis;* 4–6 in *sequoicola;* 8 in *Traski;* 8 in *facta;* 6 in *Kelletti;* 9 of unequal size in *Stearnsiana*. The jaw of *ruficincta* differs in having over 10 ribs covering its whole surface, and in being only slightly arcuate.

Fig. 59.



Jaw of *Helix arrosa*.

Fig. 60.



Lingual dentition of *Helix facta*.

I have not examined the following species: *intercisa*, *Mormonum*, *Dupetithouarsi*, *Gabbi*.

The subgenus is almost exclusively confined to our limits. There is, however, one *Mexican* species, one African, and one European, *H. arbustorum*. The jaw of the last agrees with our species.

The lingual membrane is long and narrow. Fig. 60 shows the general arrangement of the teeth upon the lingual membrane. The characters of the individual teeth are shown in my plates. I have selected *H. Stearnsiana* pl. XIII., fig. 3, to give an idea of the teeth in successive transverse rows. Fig. *a* shows a group of central and lateral teeth in two adjacent rows, *b* the transition from laterals to marginals, *c* marginal teeth from near the outer edge of the membrane. The central teeth have a base of attachment much longer than wide, with incurved lower margin and expanded lower lateral angles; the upper margin broadly reflected; reflection short, stout, with subobsolete side cusps bearing no cutting points, and a stout, long median cusp bearing a short, blunt cutting point, which does not reach the lower margin of the base of attachment; the reflection with the median cusp is pear-shaped; in many species there is a duplicate line of reënforcement parallel to the upper margin of the base of attachment. The lateral teeth are of similar type to the centrals, but are unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment. The outer laterals have a side cusp and cutting point. The transition from laterals to marginals is formed by the greater proportional development of the cutting point, the lesser development of the cusp; the cutting point then becomes bifid, the reflection becomes more nearly the same size as the base of attachment, and thus the true marginals are gradually reached. These last are longer than wide, have a base of attachment smaller than the reflection and cut away on its lower inner angle; the reflection is produced into one long, sharp, oblique, bifid cutting point, the inner division the smaller, and one outer, much shorter, sharp, rarely bifid cutting point.

Most of the species examined agree in dentition with *Stearnsiana*. Some have more blunt cutting points to their marginals, as *H. sequoicola* (pl. XIV., fig. 5), but even on various parts of the same membrane the marginals vary in this respect. In *Kelletti*, *Stearnsiana*, *tudiculata*, *arrosa*, *Traski*, *sequoicola*, *Ayresiana*, *redimita*, *Nickliniana*, *ramentosa*, *exarata*, I have failed to detect any side cutting points to the central and inner lateral teeth. I found the points, however, in *H. ruficincta* (pl. XIV., fig. 3). *H. Townsendiana* (pl. XVIII., fig. 8) has these cutting points and side cusps on central and all the lateral teeth; its centrals and laterals are not of the same shape as described above for *H. Kelletti*, but resemble those of *Polygyra*, *Stenotrema*, and *Triodopsis*. Thus in this as in other subgenera, we find the type of dentition not constant in all the species.

The long, narrow base of attachment and pyriform reflection of most of the species of *Arionta* agree with those of *Hemitrochus* (see p. 181) more nearly than any other of our genera or subgenera, but that genus has quite different marginal teeth.

The dentition of *H. arbustorum* is alone known of the species foreign to America, and that by a figure of Lehmann (Lebenden Schnecken, pl. XI., fig. 29) too unsatisfatory to be of value for the purpose of comparison.

H. arrosa (pl. XIV., fig. 2), 54—1—54 teeth. 17 laterals.

H. Townsendiana (pl. XVIII., fig. 8) has 60—1—60. Another membrane had 40—1—40.

H. tudiculata (pl. XIV., fig. 1), 50—1—50, with 26 perfect laterals.

H. Nickliniana (pl. XIV., fig. 8).

H. Ayresiana (pl. XIV., fig. 6), 50—1—50, with 15 perfect laterals.

H. redimita (pl. XIV., fig. 7). The 17th tooth has its inner cutting point split. 43—1—43.

H. intercisa, not examined.

H. exarata (pl. XIV., fig. 10), 54—1—54, 19 perfect laterals.

H. ramentosa (pl. XIV., fig. 9), 60—1—60, with 21 perfect laterals. The 18th tooth has the side cutting point.

H. Californiensis (see L. and Frw. Sh., 1., p. 171, fig. 297). Teeth 56—1—56.

H. Carpenteri. Too late for illustration, I have received specimens collected by Mr. Henry Hemphill. There are 48—1—48 teeth, with 20 laterals; the side cutting points are visible beyond the 7th tooth.

H. Mormonum, not examined.

H. sequoicola (pl. XIV., fig. 5), 46—1—46, 18 perfect laterals.

H. Diabloensis.

Too late for illustration, I have received from Mr. L. G. Yates specimens of the form called *Diabloensis* by Dr. Cooper. There are 37—1—37 teeth, with 17 laterals. There are side cutting points beyond the 12th tooth.

H. Traski (pl. XIV., fig. 4), 36—1—36; the 13th tooth has the side cutting point; 16 laterals.

H. Dupetithouarsi, not examined.

H. ruficincta (pl. XIV., fig. 3), 35—1—35, with 18 laterals.

H. Gabbi, not examined.

H. facta (see p. 216, fig. 60), 29—1—29, with 11 laterals.

H. Kelletti (pl. XIII., fig. 4), 57—1—57.

H. Stearnsiana (pl. XIII., fig. 3), 50—1—50, with 24 laterals. The 22d tooth has the side cutting point.

Subgenus GLYPTOSTOMA.[1]

One species only is thus far known, *Helix Newberryana*. Its jaw (pl. XVI., fig. 4) is low, wide, slightly arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous (about 16), stout, separated ribs, deeply denticulating either margin.

Lingual membrane (pl. XIII., fig. 6) long and narrow. Teeth 47—1—47, with 17 perfect laterals. Centrals with the base of attachment long and narrow, with greatly expanded lower, lateral angles, the upper margin rounded, broadly reflected; reflection large, stout, with obsolete side cusps, but with decided, triangular side cutting points; median cusp very stout, short, with a long, acute cutting point reaching beyond the lower edge of the base of attachment. Laterals like the centrals, but unsymmetrical by the suppression of inner, lower, lateral angle of the base of attachment and inner side cutting point. The transition from laterals to marginals is marked by the lesser proportional development of the cusp and greater development of the cutting point. Marginals (*c*) low, wide, the reflection equalling the base of attachment and bearing one inner, short, stout, oblique, blunt cutting point, and one outer, shorter, blunt cutting point.

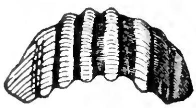
This species, like all others, has great variation in the development of the cutting points on different parts of the same membrane.

Subgenus EUPARYPHA.

Jaw high, arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with a few (about 5 in *Tryoni*) stout, separated, unequal ribs, deeply denticulating either margin.

[1] See Proc. Phila. Ac. Nat. Sci., 1873, p. 244.

Fig. 61.



Jaw of *H. Tryoni.*

As usual in most of the species of *Helix*, etc., examined by me, the number, size, and disposition of the ribs vary in different individuals of the only species of *Euparypha* I have examined, *H. Tryoni.* In L. and Frw. Shells N. A., I., 179, six jaws are figured, all differing as to the ribs.

I have had no opportunity of examining *H. areolata*, the only other species found within our limits. Among the species of the subgenus foreign to the United States, *H. pisana*, Müll., alone has been examined, the jaw being figured by Moquin-Tandon with 2–3 ribs only, and the number of the teeth being given by Thomson.

The only information I can give of the lingual dentition is shown in the figure of that of *H. Tryoni* (L. and Frw. Shells, I., 354). There are 190 rows of about 43—1—43 teeth each. There appear to be 16 perfect laterals.

The base of attachment is long and narrow; the reflection is pear-shaped, apparently without side cusps or cutting points in the central and first nine laterals. The balance of the laterals have the side cusp, and, no doubt, cutting point. I cannot from the figure describe accurately the characteristics of the marginal teeth. Unfortunately, I have preserved no membrane to describe and figure more accurately.

Subgenus Tachea.

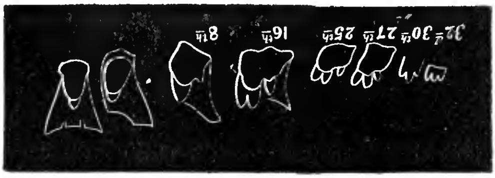
Our single species, *H. hortensis*, found only along the north-eastern coast, and there usually restricted to the islands, agrees in its jaw with the other known species of the subgenus. It is stout, arched, with blunt unattenuated ends; anterior surface with stout, few, separated ribs, denticulating either margin.

Fig. 62.

Jaw of *Helix hortensis*. [Morse.]

The lingual membrane has 116 rows of 32—1—32 teeth each. The centrals have a subtriangular base of attachment, so greatly are the lower lateral angles expanded; upper margin reflected; reflection pear-shaped, without outer cusps, but a single stout middle cusp, half as long as the base of attachment, and bearing a short, conical cutting point, reaching only about one-half the distance to the lower edge of the base of attachment. First laterals like the centrals, but unsymmetrical by the irregular cutting away of the lower inner angle of the base of attachment; outer laterals with a more developed cutting point and a decided side cusp and cutting point; the change from the laterals to the marginals is shown in the 16th tooth (see fig. 63), where the base of attachment is wider, the reflection stouter and the inner cutting point becomes bifid. The marginals are low, wide, the reflection equalling the base of attachment, the inner cutting point short, bluntly bifid, the outer shorter and blunt.

Fig. 63.



Lingual dentition of *Helix hortensis*. [Morse.]

Having no specimen to examine myself, I am dependent on Morse's figures given above.

Subgenus Pomatia.

Jaw of our only species, *H. aspersa*, introduced by commerce at Charleston, S. C. (where it is still common), high, thick, arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with 6 stout, separated ribs, deeply denticulating either margin (pl. XVI., fig. 8).

Lingual membrane of the same species (pl. XIII., fig. 7, *a*, *b*, *c*) long and narrow. Teeth 50—1—50, with 15 perfect laterals. Centrals with base of attachment longer than wide, the lower lateral angles but slightly produced, the lower margin in some cases with a quadrate excavation or thinning as usually found in *Succinea;* the upper margin broadly reflected, reflection very large, with a very stout, short median cusp, bearing a short, stout cutting point reaching the lower edge of the base of attachment; side cusps obsolete, but bearing well developed, short side cutting points. Laterals like centrals, but unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the inner side cutting point. Transition teeth from the laterals to the marginals (*b*) with a more developed reflection, a shorter inner cusp bearing a greatly developed bifid cutting point. Marginals (*c*) low, wide, the reflection equalling the base of attachment and bearing one inner, long, oblique, acutely bifid cutting point, and one shorter, outer, sometimes bifid, side cutting point.

The only other *Pomatia* whose dentition has been figured is *H. pomatia*, which shows the same type of teeth (Goldfuss, l. c. pl. IV., fig. 6). The jaw of numerous European species is known, and of the same type as in *aspersa.*

(3) Jaw with delicate, distant ribs to its anterior surface, usually running obliquely to the median line.

Genus **CYLINDRELLA**, Pfr.

Jaw as in *Macroceramus*, described below.

Lingual membrane of our two species *C. jejuna* and *C. Poeyana* not examined by me. The dentition of the genus is very peculiar. The membrane is exceedingly long and narrow. The base of attachment of the centrals is small, long, narrow, with the upper margin broadly reflected into a blunt, rounded and expanded gouge-shaped cutting point; the laterals have a long, subquadrangular base of attachment, bearing below, a large, bluntly rounded, greatly expanded, palmate cusp, representing the inner and central cusps of the laterals; and, above, a long, slender, graceful extension, representing the external cusp of the other *Helicidæ*. This last is bluntly truncated, or bears a recurved cusp smaller but of same shape as that below; or it has a laterally extended, small blunt point. In some species the laterals extend to the margin of the lingual membrane;[1] in others there are distinct marginal teeth, long, narrow, laminar, with bluntly recurved apices. A full description and figures of these various forms of teeth will be found in Journal de Conchyliologie, January, 1870.

Fig. 64.

Lingual dentition of *Cylindrella scæva*. [Bland.]

I here give a figure of the dentition of one only of these types represented by the membrane of *C. scæva*.

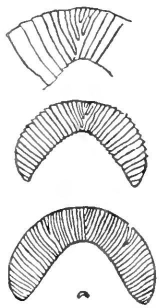
[1] Probably this is the case in our species, as it is so in the allied *C. elegans*. See pl. XX., fig. 6.

Since the above was written, I find my anticipations realized in the case of *C. Poeyana*. Specimens from Key West collected by Mr. W. W. Calkins, have 14—1—14 teeth of same type as in *elegans*. There are over 40 ribs on the jaw.

Genus **MACROCERAMUS**, Guild.

Jaw thin, almost membranous, semi-transparent, light horn colored, strongly arched, ends acuminated; cutting margin without median projection; anterior surface with numerous delicate, separated ribs, denticulating both margins; these ribs run obliquely towards the median line of the jaw, so that the central ribs meet before reaching the lower margin of the jaw, forming an upper median triangular space between the ribs.

Fig. 65.



Jaw of *Macroceramus signatus*. [Bland.]

It was formerly considered that this jaw was actually in separate pieces, whose overlapping margin formed the ribs upon the anterior surface (see fig. 65). More careful examination, however, has proved the jaw to be in one single piece, with delicate ribs upon its surface.

There are over 50 ribs on the jaw of the only one of our species I have examined, *M. Gossei*. I give a copy of Mr. Bland's figure of the jaw of *M. signatus*, which is similar.

The lingual membrane of *Macroceramus* was supposed to be the same as in *Cylindrella* described above, as that of *M. signatus* was so found by Mr. Bland (Ann. Lyc. Nat. Hist. N. Y., VIII., 162), and Crosse and Fischer (Journ. de Conch., 1870, pl. III., fig. 14–16). It was, therefore, with surprise that I found an entirely different type of dentition in *M. Gossei*. I can in this place only note the difference, and leave to future study the question of its bearing on the generic position of the species.

M. Gossei (pl. XV., fig. 1) has a membrane very long and narrow; teeth about 40—1—40, in scarcely oblique transverse rows, decidedly not *en chevron*. Centrals with a long, narrow base of attachment with somewhat expanded lower lateral angles, its upper margin squarely reflected. The reflected portion is very small, and bears three short, blunt cusps, the median the largest, all three with distinct cutting points. The base of attachment of the laterals is long and narrow, its outer lower angle irregularly cut away; the upper margin broadly and obliquely reflected, the reflected portion thrown off obliquely towards the margin of the lingual membrane, very short and bearing two stout, blunt, short cusps, the inner the larger, also thrown obliquely towards the outer margin of the membrane; both of the cusps bear distinct cutting points, the outer one small, the inner one narrow, blunt, almost as long as the base of attachment. There are no distinct marginals, the laterals decreasing in size as they pass off laterally, those at the edge of the membrane (fig. *c*) having one large inner cutting point, and several, outer, irregular smaller ones. I have given *a* a group of centrals and laterals, *b* a group of laterals, and *c* an extreme lateral or marginal.[1]

I have had no opportunity of examining *M. Kieneri.*

Genus **BULIMULUS**, Leach.[2]

Jaw thin, arcuate, ends but little attenuated; no median projection to the cutting edge; anterior surface with numerous, separated, delicate ribs, denticulating either margin, sometimes the upper median ones running obliquely towards the median line, or even arranged *en chevron* as in *Macroceramus*, with an upper median triangular compartment.

Fig. 66.

Jaw of *Bulimulus dealbatus.*

The jaw of *B. dealbatus* is here figured. It is quite arched. That of *B. Marielinus* and *alternatus* is of the same type. I have given on plate XVI., fig. 12, a more enlarged view of one end of the jaw of *B. sufflatus*, to show more accurately the character of the ribs.

The lingual membrane of the genus as now received varies too much to allow of a general description. It can only be said that the marginal teeth are quadrate, not aculeate. I will here simply confine myself to describing the membrane of the only one of our species of which I have preserved the lingual membrane.

Fig. 67 shows the general arrangement of the teeth on the membrane of *B. dealbatus*, the characters of the individual teeth being shown in pl. XV., fig. 7. There are 94 rows of 25—1—25 in one specimen examined. Another had 20—1—20 teeth, with 14 perfect laterals.

The central tooth has a base of attachment longer than wide, with but little expanded lower lateral angles, its lower margin

[1] Similar dentition is found in *M. turricula*, Pfr., of Cuba. See below, pl. XX, fig. 9.

[2] I use this generic name only temporarily. As suggested by von Martens, it must eventually be restricted to those species whose dentition is like that of *B. Guadelupensis*, the type of the genus.

incurved, its upper margin broadly reflected. The reflection is large and has subobsolete side cusps bearing well developed cutting points, and a short, stout median cusp, bearing a short, stout cutting point not quite reaching the lower margin of the base of attachment. The laterals are of the same general form as the

Fig. 67.

Lingual dentition of *Bulimulus dealbatus*.

centrals, but are larger, broader in proportion, and are rendered unsymmetrical by the suppression of the lower inner angle of the base of attachment, and inner side cusp and cutting point. The marginal teeth (fig. *b*) are but a simple modification of the laterals, formed by the proportionally greater development of the reflection in comparison with that of the base of attachment, and the greater development of the cutting points. On the extreme marginals the cutting points are shorter and much blunter (fig. *c*).

The dentition of *Bulimulus alternatus* is figured on p. 203 of L. and Frw. Shells, I. I have preserved no specimen from which I can more accurately draw the individual teeth. It has 75 rows of 37—1—37 teeth, all apparently of the same character as in *B. dealbatus*.

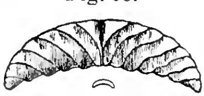
I have not examined *B. multilineatus*, *Dormani*, *Marielinus*, *Floridanus*, *patriarcha*, *Schiedeanus*.

c. Jaw in numerous distinct pieces, sometimes soldered together above, free and imbricated below. Marginal teeth quadrate. ORTHALICINÆ.

Genus **LIGUUS**, Montf.

Jaw thick, arcuate, ends rapidly attenuated, pointed ; composite, being in numerous, separate, free, imbricated, triangular pieces, with sutures inclined obliquely to the centre of the jaw, so as to leave an upper median, angular piece ; other pieces are soldered together above. Cutting edge with no median projection, serrated by the lower angles of the oblique pieces. For more detailed description see below, under *Orthalicus*, which has a similar jaw. I am

Fig. 68.



Jaw of *L. virgineus*.

not able to give a figure of the jaw of the only species found within our limits, *L. fasciatus*. It is however figured by Leidy (Terr. Moll. U. S., I., pl. V., fig. 4, *a*, *b*). It is similar to that of the allied species *L. virgineus*, which is here figured on p. 225.

The only species found within our limits, *L. fasciatus*, has about 69—1—69 teeth, judging from a membrane examined by me. That figured in L. and Frw. Shells, I., p. 214, has 94 rows of 55—1—55 teeth each. As elsewhere stated, there is often a difference in the number of transverse teeth in almost all species, and indeed upon different parts of the same membrane.

The central tooth (pl. VI., fig. E, *a*) has a base of attachment long and narrow, with strongly incurved sides, widely expanded, excurved and fringed lower margin, and upper margin less expanded, rounded, and broadly reflected. The reflection is stout and very rapidly narrows without any appearance of side cusps into a very broad, long, bluntly rounded median cusp, bearing a still broader, short, bluntly truncated cutting edge (as such a blunt organ cannot be called a point) reaching nearly to the lower edge of the base of attachment. It may be that I have here incorrectly considered the upper margin of the base of attachment as reflected and extended into the cusp. As in the case of the side teeth, I should, perhaps, rather say that the upper margin is not reflected, but that just below the middle of the base of attachment there springs up from its surface a broad, gouge-shaped cusp, bearing a still broader cutting edge (see pl. VI., fig. E, *d*, where the form of the cusp of the side teeth is shown by the profile). The side teeth run rapidly and obliquely backward from the central tooth, thus giving a chevron-like arrangement to the membrane. The teeth are crowded together both longitudinally and transversely, excepting as they approach the outer edges of the membrane, where they are much more separated.

I have used the term side teeth instead of lateral and marginal teeth, because it is difficult to decide which of these types they properly are. Taking into consideration the fact of there being distinct lateral teeth in the allied species, *L. virgineus*, and that the marginals of that species resemble the side teeth of *L. fasciatus*, I am inclined to believe we should consider all the side teeth of *fasciatus* as marginals. In this case we must consider that the lateral teeth are entirely suppressed. The marginals, as I have decided to call them, are of the same type as the centrals.

The base of attachment is, however, unsymmetrical by the suppression of both upper and lower inner lateral expansion; the upper margin is simply squarely truncated. Above the centre of the base of attachment springs from its surface the gouge-shaped, rounded, gradually expanding cusp reaching nearly the lower margin of the base of attachment and produced into a still more expanded, bluntly truncated cutting edge (one cannot call it a cutting point), which projects far beyond the lower margin of the base of attachment on to the teeth of the next transverse row, and is also greatly expanded on the outer side, so as to overlap the adjoining tooth. This cutting edge is slightly incurved at its centre. There is one point of difference between the central and adjoining marginal teeth which is very marked; in the centrals the lower margin of the base of attachment is more expanded than the cutting edge, the reverse of which is found in the marginals.

The marginals retain this general form to the extreme edge of the membrane, but they decrease greatly in size upon the edge. The outer marginals have to their cusps a small side spur, gouge-shaped as the cusp itself; the extreme marginals have such a spur at either side. In both cases the cutting edge springs from the outer side of this side spur, which must be considered as representing the side cusps of the usual *Helicinæ* type of dentition. I have elsewhere (Ann. Lyc. N. H. of N. Y., XI., 39) shown that this type of tooth is but a modification of the usual type brought about by the expansion, bluntly rounding and shortening of the cusps, and the still greater expansion, bluntly rounding and shortening of the cutting points, which are quite changed into wide cutting edges.

I have given on pl. VI., fig. E, a group of central and marginal teeth in *a*, an outer marginal in *c*, a marginal in profile in *d*.

The allied species *L. virgineus* differs from *fasciatus* in having a long blunt cutting point to its central tooth, and by the presence of several true lateral teeth with long cutting points, also in the presence of several teeth showing a gradual change from the laterals to the marginals. A full description and detailed figures of its dentition are given by me in Ann. Lyc. Nat. Hist. N. Y., XI., 41, pl. III.

Liguus is nearly allied in its lingual dentition to *Orthalicus*, but in that genus also I have found one species with true lateral teeth, as will be shown below.

Genus **ORTHALICUS**, Beck.

Jaw composite, in numerous free, imbricated pieces, usually with its sutures oblique to the centre of the jaw, leaving an upper, angular, median piece; these pieces soldered together above. No median projection to the cutting edge, which is serrated by the lower angles of the separate pieces.

The jaw of the only species within our limits, *O. undatus*, Brug. (pl. XVI., fig. 13) is of the type usual in this genus and *Liguus*, but up to the present time never observed in any other genus. It is composite, its separate pieces being apparently soldered firmly at their upper portions, where, indeed, they seem collectively to form a jaw in a single piece as in *Helix*, etc., but at their lower portion positively detached and free, imbricated one upon another. The jaw may in one sense be said to be in a single piece, as argued recently by Messrs. Fischer and Crosse (Moll. Mex. et Guat.), but with equal correctness it may surely be said to be composite, as the amalgamation of the upper portion is produced by the joining of absolutely separate pieces. There are seventeen of these plates in the jaw figured, though the number varies, the upper central one apparently lying upon the adjoining ones, which are broad and extend from the upper to the lower margin of the jaw. The jaw is strongly arched, with attenuated, blunt ends. There are well-marked perpendicular grooves upon the anterior surface of many of the plates The upper central plate is triangular, from which fact the name *Goniognatha* has been applied to the section I have called *Orthalicinæ*. *Cylindrella*, *Macroceramus*, *Pineria*, *Partula*, and some species of *Bulimulus* also have an upper median triangular compartment to their jaw, but in their case the jaw is in one single piece, with distant, delicate ribs, running obliquely to the central line, some of the upper ones meeting before reaching the lower margin of the jaw, thus leaving a triangular space, not a separate piece.

I have myself figured the jaw of *O. melanochilus*, Val., under the name of *O. zebra* (L. and Frw. Shells N. A., I., p. 215, fig. 367), of *gallina-sultana* (Ann. N. Y. Lyc. Nat. Hist., XI., pl. IV., fig. E). The last named has also been figured by Troschel (Arch. für Nat., 1849, pl. IV., fig. 3); the jaw of *O. iostomus* is figured by Crosse and Fischer (Moll. Mex. et Guat., pl. XIX., fig. 8), and *O. longus* by the same authors (l., c. pl. XIX., fig. 1). I have also examined the jaw of *O. obductus*, Shuttl. (Ann. Lyc. N. H. of N. Y., XI., p. 37.) All these species have the same composite type of jaw.

The lingual dentition of *Orthalicus undatus* is so nearly similar to that of *Liguus fasciatus*, that I merely compare it with the description given above of that species. In *O. undatus* the central tooth (pl. VI., fig. D) is broader in proportion to its length; the base of attachment is less expanded at the upper margin, and very much less so at its lower margin, and the sides are not incurved; the cusp is stouter, longer, reaching the lower edge of the base of attachment, and it has subobsolete, but distinctly marked side cusps; the cutting edge is much more expanded, overlapping the next row of teeth. The first marginals differ from those of *L. fasciatus* in having a less developed cutting edge, the outer marginals have the side spurs to their cusps much more developed and even the cutting edge is trilobed. The extreme marginals are not so small. There are about 53—1—53 teeth, on one part of one membrane; a wide part of another membrane had 106—1—106.

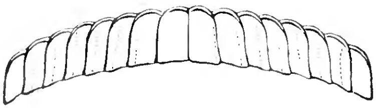
All the species of *Orthalicus* enumerated above whose dentition is known have the same type of teeth as *O. undatus*, excepting *O. gallina-sultana*. This last (see Ann. Lyc. N. H. of N. Y., XI., 38, pl. IV., fig. A) is peculiar in having a long, stout cutting point with subobsolete side points to its central tooth, and three lateral teeth of same form but unsymmetrical. Thus in both *Liguus* and *Orthalicus* we find the usual type of dentition is not constant excepting as to the marginal teeth.

O. zebra. Too late for illustration I have received specimens from Key West, collected by Mr. W. W. Calkins. It is the form figured in Terr. Moll. U. S., IV., pl. LXXVIII., fig. 12, and copied in L. and Frw. Shells N. A., I., p. 216, fig. 370 (not fig. 371, which is referred by Fischer and Crosse to *O. melanochilus*, Val.). The jaw has 7—1—7 separate pieces. The lingual membrane has 126—1—126 teeth. The teeth are of same type as in *O. undatus*, but the cutting edge of the centrals and first laterals is shorter than the base of attachment. It is, perhaps, a variety of *undatus*.

Genus **PUNCTUM**, Morse.

But one species of this genus has been described, *P. pygmæum*, Dr., hitherto known in America as *Helix minutissima*, Lea. A full account of its history with all published information relating to it has been given by Mr. Bland and myself in Ann. of Lyc. Nat. Hist. of N. Y., X., 306. The jaw is low, wide, slightly arcuate, with blunt, squarely truncated ends; it is composed of sixteen separate pieces, each higher than wide, with slightly overlapping edges; these pieces do not run obliquely towards the middle of the jaw, there is, therefore, no appearance of an upper median triangular piece as in *Orthalicus* and *Liguus*.

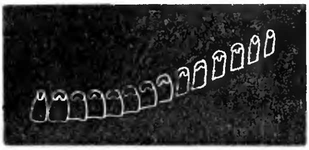
Fig. 69.



Jaw of *F. pygmæum*. [Morse.]

The lingual membrane is long and narrow. There are 54 rows of 13—1—13 teeth each. The centrals have a base of attachment much longer than wide, expanded below and squarely truncated, very much narrowed above, reflected. The reflection is very small and has, according to Morse, one single cusp, but Schacko (Malak. Blatt. 1872, 178) describes the reflection in some European specimens as tricuspid. Laterals of same form as centrals, but with wider base of attachment in the first ones and bicuspid; outer laterals much narrower. There are no distinct marginals. All the teeth are decidedly separated.

Fig. 70.



Lingual dentition of *P. pygmæum*. [Morse.]

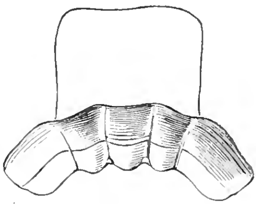
I have not examined the jaw or lingual membrane of this species, but am entirely dependent on Morse for the descriptions and figures of the American form given above. While treating of the identity of the American and European forms in the paper referred to above, we have pointed out the differences in the jaw and membrane of the two forms, which, however, do not appear to be of specific value.

d. Jaw in a single piece, with an accessory, quadrate plate above. Marginal teeth quadrate. SUCCININÆ.

Genus **SUCCINEA**, Drap.

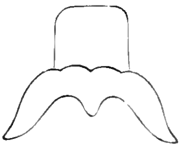
Jaw with an upper, quadrangular, accessory plate. The jaw is strongly arched, the ends acuminated in *S. avara* (fig. 71), blunt in *obliqua*, *ovalis*, *Totteniana* (fig. 71), *campestris*, *lineata*, and *effusa*: there is a median projection to the cutting margin, sometimes broken by the ends of ribs. These ribs are found in *S. Totteniana* (3) (see fig. 71); *S. obliqua* (3–7); *ovalis* (over 7); I detected no ribs on that of *S. avara*, *lineata*, *campestris*, *Nuttalliana*, *Sillimani*, or *effusa*.

Fig. 71.



Jaw of *Succinea Totteniana*. [Morse.]

Fig. 72.



Jaw of *Succinea avara*.

The general arrangement of the lingual membrane is shown in fig. 73 of *S. avara*, while the characters of the separate teeth

Fig. 73.

Lingual dentition of *Succinea avara*.

are better seen in pl. XV., fig. 3. The peculiar character of the dentition is the cutting away or thinning of the middle portion of the lower edge of the base of attachment in the central teeth, and the inner lower lateral angle of the base of attachment in the laterals and still more in the marginals. The marginal teeth are also often peculiar in the denticulation of their reflected cusps. They have usually two small outer side cusps, the inner the smaller, each bearing cutting points proportioned to their size. The reflection of the teeth is also small in proportion to the base of attachment. In other respects the dentition of the genus is very much like that of the *Helicinæ*.

Succinea Sillimani (pl. XVII., fig. 12) has 24—1—24 teeth.

Succinea ovalis has not been examined by me. Morse gives 80 rows of 40—1—40 teeth.

Succinea lineata (pl. XV., fig. 11) has 26—1—26 teeth, with 4 perfect laterals, but the transition to marginals is very gradual. The teeth have a very broad base of attachment, and very slender, sharp cutting points.

Succinea avara (pl. XV., fig. 3) has 21—1—21 teeth, with about 8 perfect laterals. Morse counted 19—1—19 teeth.

Succinea obliqua (pl. XV., fig. 4) has 43—1—43 teeth, with 10 perfect laterals.

Succinea Totteniana is said by Morse, whose figure is given in L. and Frw. Shells, I., p. 267, to have 100 rows of 33—1—33 teeth. The bases of attachment are very narrow.

Succinea campestris (pl. XV., fig. 10) has 18—1—18 teeth, with about 10 perfect laterals. Morse gives 50 rows of 30—1—30. The central tooth has a peculiarly narrow base of attachment, and a very greatly developed median cusp, the side cusps being subobsolete.

Succinea Nuttalliana (fig. 74). Teeth 19—1—19.

Fig. 74.

Succinea effusa (pl. XV., fig. 6) has 15—1—15 teeth, with 10 perfect laterals.

Succinea Stretchiana (pl. XX., fig. 7). 16—1—16. 8 laterals.

I have had no opportunity of examining the other species of *Succinea* found within our limits.

Family VERONICELLIDÆ.

Genus **VERONICELLA** Blainv.

Jaw (fig. 75) low, wide, thick, slightly arcuate; ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous, stout, crowded ribs, denticulating either margin, 24 in *V. Floridana*.

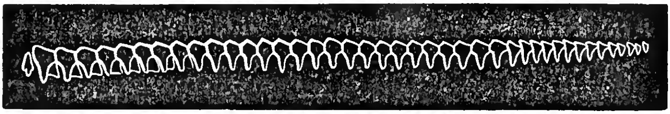
Fig. 75.

Jaw of *Veronicella Floridana.*

Lingual membrane, as seen in fig. 76, is arranged as usual in the *Helicinæ*, the transverse rows being almost horizontal. By fig. 11 of pl. XVII., representing *V. Floridana*, it will be seen that the teeth are of a very peculiar type.

The lingual membrane is long and very broad, comprising (in the Florida species) about 60—1—60 teeth. The centrals have their base of attachment quite small, long and narrow, attenuated to a point above, gradually enlarging toward the base, above which are lateral, bluntly pointed, wing-like expansions ; the lower margin is broad, and has a deep, rounded excavation; in some cases the lateral expansions are so produced as to give an almost cruciform appearance to the base of attachment; below the centre of the base of attachment, on its anterior surface, is a stout, blunt, short, simple cusp, ending in a short, stout cutting point.

Fig. 76.



Lingual dentition of *Veronicella Floridana.*

The lateral teeth are very irregular in shape, but retain the bicuspid character peculiar to the *Geophila ;* they are longer and much wider than the centrals; the bases of attachment are very irregular in shape, very unsymmetrical, subquadrate or irregularly excavated above, thence curve outwards and downwards, until at their lower extremity they exhibit the lateral expansions and basal excavation of the central tooth, but both these characters are much more developed than in the centrals, and from the want of symmetry in the teeth, are found only on the outer side of each tooth ; the upper edge is squarely reflected, the reflection is very large, extends half way to the lower edge of the base of attachment, and is produced beyond that into a blunt, stout cusp bearing a stout cutting point; the side cusps are almost obsolete, the inner one is much larger than the outer one, neither with distinct cutting point. The marginal teeth are a simple modification of the laterals, being reduced to a subquadrate shape, with the cutting point of the cusp much more produced.

I give on pl. XVI., fig. 11, a group of centrals and laterals in *a*, a marginal in *b*.

I have not been able to examine *V. olivacea*, the only other species found within our limits.

The species of the genus foreign to the United States hitherto examined agree in their jaw and lingual dentition with *V. Floridana*.

EXPLANATION OF THE PLATES.

Plate I.

Fig. 1. Glandina truncata, Say.
- *a*. Central and adjacent marginals.
- *b*. The twentieth tooth.
- *c*. The last tooth.

Fig. 2. Macrocyclis Duranti, Newc.
- *a*. Central and adjacent teeth.
- *b*. The last two teeth.

Fig. 3. M. concava, Say.
- *a*. Central and adjacent teeth.
- *b*. The last ten teeth.
- *c*. The last tooth from another part of the membrane.

Fig. 4. M. Vancouverensis, Lea.
- *a*. Central and adjacent teeth.
- *b*. The last five teeth.
- *c*. The first lateral seen from above on a different scale of enlargement.

Fig. 5. M. Voyana, Newc.
- *a*. Central and adjacent teeth.
- *b*. Extreme marginals.

Note.—This plate must be studied in connection with the descriptions in the text. It will there be seen that Fig. 2*a* and Fig. 4*a* are taken from below, to better show the base of attachment. Figs. 3*a*, 5*a*, and 4*c* are taken from above, and more correctly show the form of the cusp.

Plate II.

Fig. 1. Zonites lævigatus, Pfr. The central tooth with all the teeth to the right of it.

Fig. 2. The same, more highly enlarged, to the fifth tooth.

Fig. 3. Zonites cellarius, Müll. Same reference as in fig. 1.

Fig. 4. Zonites friabilis, W. G. B.
- *a*. Central and adjacent lateral.
- *b*. Extreme marginals from two adjacent rows.

Fig. 5. Zonites inornatus, Say.
- *a*. Central and first three laterals.
- *b*. Marginal tooth fourth from the end.

Fig. 6. Zonites capnodes, W. G. B.
a. Central and first lateral.
b. Marginal teeth.

Fig. 7. Zonites fuliginosus, Griff.
a. Central and first lateral.
b. Third marginal from edge of lingual membrane.

Plate III.

Fig. 1. Zonites gularis, Say.
a. Central and first lateral tooth.
b. Marginal tooth.

Fig. 2. Zonites sculptilis, Bland.
b. Extreme marginals.

Fig. 3. Zonites limatulus, Ward.

Fig. 4. Zonites capsella, Gould.

Fig. 5. Zonites Elliotti, Redf.
b. An extreme marginal.

Fig. 6. Zonites demissus, Binn.

Fig. 7. Zonites lasmodon, Phillips.
c. Last marginal but three.

Fig. 8. Zonites intertextus, Binn.

Fig. 9. Zonites internus, Say.
b. The 16th and 17th tooth.
c. The 25th tooth.

Fig. 10. Zonites Gundlachi, Pfr.
b. A group of marginals.

Fig. 11. Zonites ligerus, Say.

Fig. 12. Zonites capnodes, W. G. B.
a, b, c, d. The base of attachment.
e. The reflection.
f, f. The obsolete side cusps.
g, g. The side cutting points.
h. The central cusp.
i. Central cutting point.

Plate IV.

Fig. 1. Limax flavus, Lin.
a. Central and first lateral teeth.
b. Marginal tooth before the bifurcation commences.
c. An extreme marginal, to show the bifurcation of the marginals.

Fig. 2. Limax Hewstoni, J. G. Coop.
a. Central and first lateral teeth.
b. Extreme marginals.

Fig. 3. Limax agrestis, Lin.
a. Central and first lateral teeth.
b. First marginal teeth.
c. Last three marginals.

Fig. 4. Limax maximus, Lin.
a. A group of central and adjacent laterals.
b. A marginal tooth before the commencement of the bifurcation.
c. An extreme marginal, showing the bifurcation.

Fig. 5. Limax campestris, Binney. Same references as in fig. 1.

Fig. 6. Vitrina Pfeifferi, Newc.
a. Central and lateral teeth.
b. Extreme marginal.

Fig. 7. Vitrina exilis, Mor.
a. Central and lateral teeth.
b. First marginals.
c. Last marginals.

Fig. 8. Vitrina limpida, Gould. Same references as in fig. 6.

Plate V.

Fig. 1. Ariolimax Californicus, J. G. Cooper.
a. Central and first lateral teeth.
b. Marginal teeth.

Fig. 2. Ariolimax niger, J. G. Cooper. Extreme marginal teeth of an exceptional form.

Fig. 3. Ariolimax niger, J. G. Cooper. Same references as in fig. 1.

Fig. 4. Prophysaon Hemphilli, Bl. and Binn. Same references as in fig. 1.

Fig. 5. Arion hortensis, Fér. Same references as in fig. 1.
c. Extreme marginal.

Fig. 6. Ariolimax Columbianus, Gld.
a. Central and first lateral teeth.
b. c. Transition teeth from laterals to marginals.
d. Marginal tooth.
e. Extreme marginal tooth.
f. Marginal tooth in profile.

Fig. 7. Hemphillia glandulosa, Bl. and Binn.

a. Central and first lateral teeth.

b. Transition from lateral to marginal teeth.

c. Marginal teeth near the edge of the membrane.

d. Extreme marginal tooth.

Plate VI.

Fig. A. Tebennophorus Caroliniensis, Bosc.

a. The central tooth.

b. The first lateral.

c. The last laterals.

d. Marginal teeth.

e. Extreme marginals.

Fig. B. Pallifera Wetherbyi.

a. Central and lateral tooth.

b. Extreme marginals.

Fig. C. Pallifera dorsalis, Binn.

a. Central and two lateral teeth.

b. Marginal tooth.

c. Extreme marginal.

Fig. D. Orthalicus undatus, Brug. The central and first, second, fifteenth, forty-eighth, and fiftieth marginals.

Fig. E. Liguus fasciatus, Müll.

a. A group of central and marginal teeth.

b. Marginal far removed.

c. An extreme marginal.

d. A marginal in profile.

Plate VII.

Fig. 1. Patula strigosa, Gld.

a. Central and lateral teeth.

b. Marginal teeth.

c. Outer marginal tooth.

d. An outer lateral on a different scale of enlargement.

e. A central tooth from an embryonic specimen.

Fig. 2. Patula Cooperi, W. G. B.

a. Central and lateral.

b. Outer marginals.

Fig. 3. Patula perspectiva, Say.

Fig. 4. Patula Idahoensis, Newc.

Fig. 5. Patula alternata, Say.
Fig. 6. Patula Hemphilli, Newc.
Fig. 7. Patula alternata, Say. Var. mordax, Shuttl.
Fig. 8. Patula Cumberlandiana, Lea.
Fig. 9. Patula solitaria, Say.
Fig. 10. Patula striatella, Anthony.

Plate VIII.

a. Central and lateral teeth.
b. The last lateral tooth.
c. Inner marginal teeth.
d. Outer marginal teeth.

Fig. 1. Helix Texasiana, Mor.
Fig. 2. Helix Troostiana, Lea.
Fig. 3. Helix uvulifera, Shuttl.
Fig. 4. Helix espiloca, Rav.
Fig. 5. Helix Hazardi, Bl.
Fig. 6. Helix septemvolva, Say.
Fig. 7. Helix Febigeri, Bl.
Fig. 8. Helix pustula, Fér.
Fig. 9. Helix auriformis, Bl.
Fig. 10. Helix Mooreana, W. G. B.
Fig. 11. Helix fastigans, L. W. Say.
Fig. 12. Helix auriculata, Say.

Plate IX.

Fig. 1. Helix Edvardsi, Bland.
a. Central and first lateral.
b. Marginal.
c. Extreme marginal.
Fig. 2. Helix polygyrella, Bland. Same references.
Fig. 3. Helix Yatesi, J. G. Coop. Same references.
Fig. 4. Helix monodon, Rack. Same references.
Fig. 5. Helix germana, Gld. Same references.
Fig. 6. Helix hirsuta, Say.
b. Transition from laterals to marginals.
Fig. 7. Helix stenotrema, Fér.
a. Central and lateral teeth.
b. Extreme marginals.
Fig. 8. Helix spinosa, Lea.
Fig. 9. Helix barbigera, Redf. References as in fig. 6.

Plate X.

Fig. 1. Helix tridentata, Say.
Fig. 2. Helix palliata, Say.
a. Central and first lateral.
b. An outer lateral.
c. A transition tooth between laterals and marginals.
d. A marginal tooth.
Fig. 3. Helix Rugeli, Shuttl.
Fig. 4. Helix inflecta, Say.
Fig. 5. Helix fallax, Say.
Fig. 6. Helix Hopetonensis, Shuttl.
b. Marginal teeth.
Fig. 7. Helix appressa, Say.

Plate XI.

a. Central and lateral.
b. Inner marginal.
c. Outer marginal.
d. Transition from lateral to marginal.
Fig. 1. Helix albolabris, Say.
Fig. 2. Helix Wetherbyi, Bl.
Fig. 3. Helix Roemeri, Pfr.
Fig. 4. Helix Downieana, Bl.
Fig. 5. Helix Sayii, Binn.
Fig. 6. Helix Clarki, Lea.
Fig. 7. Helix exoleta, Binn.

Plate XII.

Fig. 1. Helix elevata, Say.
Fig. 2. Helix Columbiana, Lea.
Fig. 3. Helix Mobiliana, Lea.
b. Extreme marginals.
Fig. 4. Helix devia, Gld.
a. Central and lateral tooth.
b. An extreme lateral.
c. Marginal teeth.
d. The last marginal.
Fig. 5. Helix profunda, Say.
Fig. 6. Helix multilineata, Say.

Fig. 7. Helix clausa, Say.
b. Marginal teeth.
c. Extreme marginals.
Fig. 8. Helix dentifera, Binney.
b. Marginal tooth.

Plate XIII.

Fig. 1. Hemitrochus varians, Mke.
a. Central and first lateral teeth.
b, *c*. Marginal teeth.
Fig. 2. Helix griseola, Pfr. Same references.
Fig. 3. Helix Stearnsiana, Gabb.
a. Group of central and lateral teeth.
b. Group of teeth showing transition from laterals to marginals.
c. A group of extreme marginal teeth.
Fig. 4. Helix Kelletti, Forbes.
a. Central and first lateral tooth.
b. Transition from laterals to marginals.
c. Extreme marginal tooth.
Fig. 5. Helix lineata, Say. Same references as in fig. 1.
b. Marginal tooth.
Fig. 6. Helix Newberryana, W. G. B. Same references as in fig. 4.
Fig. 7. Helix aspersa, Müll. Same references as in fig. 4.
Fig. 8. Helix fidelis, Gray. Same references as fig. 4.
Fig. 9. Helix infumata, Gld.
a. Central and first lateral tooth.
b, *c*. Transition teeth from different parts of the membrane.
d. Extreme marginal teeth.

Plate XIV.

a. Central and lateral teeth.
b. Transition from laterals to marginals.
c. Inner marginal teeth.
d. Outer marginal teeth.
Fig. 1. Helix tudiculata, Binn.
Fig. 2. Helix arrosa, Gld.
Fig. 3. Helix ruficincta, Newc.
Fig. 4. Helix Traski, Newc.
Fig. 5. Helix sequoicola, J. G. Coop.

Fig. 6. Helix Ayresiana, Newc.
Fig. 7. Helix redimita, W. G. B.
Fig. 8. Helix Nickliniana, Lea.
Fig. 9. Helix ramentosa, Gld.
8. The eighth tooth—an outer lateral.
Fig. 10. Helix exarata, Pfr.

Plate XV.

a. Central and lateral teeth.
b. Inner marginal tooth.
c. Outer marginal tooth.
Fig. 1. Macroceramus Gossei, Pfr.
Fig. 2. Pupa rupicola, Say.
Fig. 3. Succinea avara, Say.
Fig. 4. Succinea obliqua, Say.
Fig. 5. Stenogyra decollata, Lin.
Fig. 6. Succinea effusa, Shuttl.
Fig. 7. Bulimulus dealbatus, Say.
Fig. 8. Stenogyra subula, Pfr.
Fig. 9. Cœcilianella subcylindrica, Lin.
Fig. 10. Succinea campestris, Say.
Fig. 11. Succinea lineata, W. G. B.
Fig. 12. Pupa fallax, Say.

Plate XVI.

Jaw of:—
Fig. 1. Stenogyra subula, Pfr.
Fig. 2. Arion hortensis, Fér.
Fig. 3. Vitrina limpida, Gld.
Fig. 4. Helix Newberryana, W. G. B.
Fig. 5. Ferussacia subcylindrica, L.
Fig. 6. Hemphillia glandulosa, Bl. and Binn.
Fig. 7. Pupa rupicola, Say.
Fig. 8. Helix aspersa, Müll.
Fig. 9. Prophysaon Hemphilli, Bl. and Binn.
Fig. 10. Helix Yatesi, J. G. Cooper.
Fig. 11. Helix polygyrella, Bl. and J. G. Coop.
Fig. 12. Bulimulus sufflatus, Gld.
Fig. 13. Orthalicus undatus, Brug.
Fig. 14. Helix griseola, Pfr.

Plate XVII.

Central, lateral, and outer marginal teeth of:—

Fig. 1. Zonites multidentatus, Binn.
Fig. 2. Zonites suppressus, Say.
Fig. 3. Zonites indentatus, Say.
Fig. 4. Zonites arboreus, Say.
Fig. 5. Zonites fulvus, Drap.
Fig. 6. Zonites viridulus, Mke.
Fig. 7. Zonites nitidus, Müll.
Fig. 8. Zonites milium, Morse.
Fig. 9. Zonites ferreus, Morse.
Fig. 10. Veronicella Floridana, Binn.
Fig. 11. Succinea Sillimani, Bland.

Plate XVIII.

a. Central and lateral teeth.
b. Transition from laterals to marginals.
c. Inner marginal teeth.
d. Outer marginal teeth.

Fig. 1. Helix Wheatleyi, Bland.
Fig. 2. Helix thyroides, Say.
Fig. 3. Helix Pennsylvanica, Green.
Fig. 4. Helix loricata, Gld.
Fig. 5. Helix Mitchelliana, Lea.
Fig. 6. Helix pulchella, Müll.
Fig. 7. Helix labyrinthica, Say.
Fig. 8. Helix Townsendiana, Lea.
Fig. 9. Helix asteriscus, Morse.
Fig. 10. Helix obstricta, Say.

Note.—The following typographical errors in the earlier pages of this paper should be carefully corrected:—

p. 141, third line from bottom, for *Paluta* read *Patula*.
p. 146, line 11, for former read latter.
p. 147, line 20, for *Anaderus* read *Anadenus*.
p. 148, line 12, for *Simpulopsus* read *Simpulopsis*.
p. 153, line 17 from bottom of right hand column, for Terussacia read Ferussacia.
line 16, for Cæcilianella read Cœcilianella; also on p. 186.
p. 154, line 11 of left hand column, for Columbianaus read Columbianus.
p. 155, note, for *ptychoptora* read *ptycophora*.

p. 180, line 13, for 5 read 8.

p. 191, line 5 from bottom, for Colkett read Calkins.

p. 165, line 19, *Z. cerinoideus*. Jaw as usual. Teeth 34—1—34, with 9 perfect laterals. Charleston, S. C. (W. G. Masyck.)

p. 171. Note. *Z. cerinoideus* also has these characteristics of *Zonites*.

p. 176, line 15, add : excepting in the absence of the peculiar inner side cutting point of that species.

p. 186. Cœcilianella. Since the above was printed, I have had an opportunity, thanks to Mr. Bland, of examining the jaw and lingual membrane of *C. Gundlachi* of St. Martin. The jaw has decided, numerous, broad, flat, slightly separated ribs, denticulating either margin.

In the plates the inner cutting point should have been bifid in pl. X. fig. 1, 16th tooth. (The fourth figure from the right is the 10th tooth.) Fig. 3, *d*. Pl. XI. fig. 1, *b*. Pl. XII. fig. 1, 31st tooth.

Helix ruficincta, pl. XIV. fig. 3. Another membrane has cutting points on all the laterals.

Helix exoleta. Two of four membranes recently examined have side cutting points to outer laterals; the inner cutting point of marginals are also bifid.

ON THE LINGUAL DENTITION AND GENITALIA OF PARTULA AND OTHER PULMONATA.

BY W. G. BINNEY.

I owe to the kindness of Dr. W. D. Hartman, of West Chester, Pennsylvania, the opportunity of examining numerous species of *Partula*. The specimens were received by him directly from Mr. Garrett. Their identification is that of the latter, and may be relied upon on account of his relations with Mr. Pease. Of their value as distinct species, however, I have nothing to say. So labelled were *Partula fusca*, Pease; *P. citrina*, Pease; *P. planilabrum*, Pease; *P. abbreviata*, Pease; *P. umbilicata*, Pease; *P. bilineata*, Pease; *P. amanda; P. virginea*, Pease; *P. gracilis*. Each of these were represented by several specimens still remaining in their shells. Each species was in a separate bottle, great care being taken to preserve their identity and pevent intermingling of species.

In addition to the above nine so-called species, there was one large bottle containing many specimens of the following: *Partula rosea*, Brod.; *P. formosa*, Pease; *P.? lugubris; P. varia*, Brod.; *P. compacta*, Pease; *P. Garretti*, Pease; *P.? dentifera*, Pease; *P. crassilabris*, Pease; *P. Hebe*, Pfr.; *P. protea*, Pease; *P. globosa*, Pease; *P. approximata*, Pease; *P. turgida*, Pease; *P. faba*, Martyn. As the species of the above lot were not separately indicated, the specimens are of value only as throwing light upon the generic characters of *Partula*. Especially as proving the constancy of the peculiar dentition of the lingual membrane, they serve an excellent purpose. To this end I have examined the membrane of all of the specimens in the bottle. The result of the examination will be given below.

The external characters of all the species agree. The animal is blunt before. The tail is long and gradually acuminated. There is no caudal mucus pore, no parallel furrows along the side of the foot, no distinct locomotive disk. The labial processes and the collar seem unusually developed. The anal and respiratory orifices are situated as usual in the shell-bearing Geophila. The genital orifice is close behind and below the right eyepeduncle. The tentacles are present in all the species, protruding in many specimens as fully as the eyepeduncles, in others inverted, but plainly visible on opening the head, and their position indicated exteriorly by a depression on the surface so plainly that I wonder at their having been overlooked by Férussac.

I have observed nothing remarkable in the nervous, respiratory, or alimentary systems.

The jaw, as already stated by me (Ann. Lyc. of Nat. Hist. of N.Y., XI. 45), is very thin, transparent, light horn-colored; slightly arcuate, its ends often gradually attenuated; in some specimens is a transverse, arched line of reënforcement above, but not parallel to, the cutting margin; there is no appearance of a median projection to the cutting margin; the whole anterior surface, even to the ends, is furnished with delicate, narrow, separated ribs, of the type well known in *Cylindrella*, *Macroceramus*, *Pineria*, *Gæotis*, *Amphibulima*, and many species of *Bulimulus*, their ends decidedly breaking the continuity of either margin: these ribs run obliquely to the median line of the jaw, so that at the centre they form a triangular space over which are (in one specimen of *P. gracilis*, some ten) ribs of unequal length, which do not reach the lower margin; there is, however, no distinct triangular compartment or separate piece, as in *Liguus* and *Orthalicus*. I have found this form of jaw in *P. fusca*, *citrina*, *planilabrum*, *abbreviata*, *umbilicata*, *amanda*, *virginea*, *bilineata*, and *gracilis*. I have not observed the jaw in all of the specimens of the species enumerated on p. 244, but in many of them which I have examined it proved the same as described above. The jaw differs in the various species in the more or less attenuation towards the ends, and also in the number of the ribs, thus in *virginea* and *gracilis* there are over 60, in *bilineata* I found but 50, while in one of the unnamed individuals I found only about 36. This last I have figured (pl. XIX., fig. 5) to show the general form of the jaw. The character of the ribs is better shown in the more enlarged view of the end of the jaw of *P. virginea* (fig. 11), while the disposition of the ribs at the centre of the jaw is shown in fig. 6 of *P. gracilis*.

The lingual membrane is broad. The central teeth (pl. XIX., fig. 4, of that of *P. amanda*) have a base of attachment long and narrow, squarely reflected above, the lower edge incurved, with slightly produced lateral expansions; the reflection is large and stout, with obsolete side cusps bearing decided, triangular cutting points, and a stout middle cusp bearing a stout cutting point which reaches to the lower edge of the base of attachment. The lateral teeth are longer and broader than the central tooth; they are unsymmetrical by the suppression of the inner cusp and cutting point, and the lower half of the base of attachment being thrown off towards the outer edge of the membrane, though its inner lower lateral expansion is not suppressed; the outer side cusp is well developed and bears a short distinct cutting point; the inner cusp is very stout and bears a very stout cutting point extending slightly beyond the lower edge of the base of attachment. The change from the lateral to the marginal teeth is formed by the lesser size of the reflected portion and the greater development of the inner cutting point, as well as by the blunt bifurcation of the outer cutting point. The marginal teeth have their base of attachment long and narrow, quadrangular, curving outward, prolonged above the reflection, which is small, but bears a highly developed cutting point obliquely and bluntly bicuspid on its outer edge, the inner division much the larger. The number of perfect laterals varies somewhat. I counted seven in *citrina*, eleven in *planilabrum*, ten in *abbreviata* and *amanda*, eight in *umbilicata*, *virginea*, and *bilineata*, five only in *gracilis*. The number of marginal teeth also varies, but they are numerous in all the species; in *virginea* I counted over one hundred and twenty. Excepting that some of the membranes had narrower teeth than others, I found no difference in them. They all agree (including those of the species named on p. 244) with the figure given by Heynemann (Mal. Blatt. 1867, t. i. fig. 1–1a.) of the dentition of *P. lirata*.

The genital system of one of the undetermined specimens is given on pl. XIX., fig. 1. The ovary (*ov.*) is small and stout; the epididymis (*ep.*) is short and greatly convoluted at the end nearer the oviduct; the testicle (*t.*), composed of short cœca, is small and embedded in the upper lobe of the liver in the very apex of the shell; the oviduct (*ovid.*) is long, convoluted; the vas deferens (*v. d.*) enters the prostate high up on the oviduct, not at its lower end, as usual; it runs down to the external orifice, then up to near the end of the penis sac, where it enters; the vagina (*v.*) is long, greatly swollen at the entrance of the duct of the genital bladder; the last mentioned organ (*g. b.*) is small, with a short duct which enlarges greatly before entering the vagina; the penis sac (*p. s.*) is large, long, bluntly terminating, with a decided constriction about its centre. In the other species examined, the retractor muscle is inserted at the end of the penis sac. The same general arrangement is found in the other species examined, *bilineata* (fig. 10), *fusca* (fig. 9), *virginea* (fig. 8), *umbilicata* (fig. 7), and in *abbreviata*, *citrina*, *planilabrum*, *amanda*. In *P. virginea* the constriction of the penis sac is much narrower and longer; the upper portion might be considered rather as a swelling of the vas deferens. In most of the specimens examined there were well formed shells of too full whorls in the oviduct, leading me to believe the genus viviparous. Thus I found embryonic young (usually only two) in *planilabrum*, *abbreviata*, *umbilicata*, *bilineata*, *amanda*, and *virginea*. Those less grown were enveloped in a sack. In *gracilis*, however, I found five white, calcareous eggs. They contained, however, shells of two whorls, so that even if this species actually lays the egg, it can only be at the moment the young animal is ready to break it. In many of the undetermined species, also, I found well formed eggs, and in some of them there were these eggs, and also embryonic young not protected by eggs. I suspect, therefore, that the young is actually brought forth living in *all cases*.

This closes my account of *Partula*. I add descriptions of several species of Pulmonata, whose dentition has not yet been published. As each lingual membrane is illustrated by a figure, I have not considered it necessary to give a detailed description.

Macrocyclis euspira, Pfr. (*Hyalina* of von Martens, p 72.)

Extracted from a dry specimen in the cabinet of Mr. Swift by Mr. Thomas Bland. Ann. L. N. H. N. Y., XI. 73.

Jaw low, crescentic, ends pointed; cutting margin with a decided, sharp median projection.

Lingual membrane long and narrow. Teeth arranged as in *Macrocyclis* (see ante, p. 158). There are, however, no transition teeth as in the American species, all the side teeth being true marginals of the aculeate type. Teeth 30—1—30 (pl. XXI., fig. 3). The centrals are deeply emarginate at the upper edge of their base of attachment, and have expanded lower lateral angles; they have also a well-marked simple median cusp with a decided cutting point.

The species is placed by Von Martens in *Ammonoceras*, a subgenus of *Hyalina*.

Nanina subcircula, Mousson.

Raiatea, Society Islands, Mr. Garrett to Dr. W. D. Hartman.

Jaw not observed.

Teeth (pl. XX., fig. 1) with obsolete side cusps, but distinct cutting points on the centrals. Laterals unsymmetrical as usual by the suppression of the inner cutting point, and inner lower lateral expansions to the base of attachment. Marginals aculeate, bifid.

The species is viviparous.

Endodonta tumuloides, Garrett.

Raratonga I., Cook's Isle. Received from Dr. W. D. Hartman, who received it from Mr. Garrett.

Teeth 17—1—17, with about 7 perfect laterals (pl. XXI., fig. 6). The base of attachment of the centrals is subequilateral. There are distinct side cutting points and cusps. The median cusp is long. Laterals unsymmetrical as usual. Transition formed as usual. Marginals low, wide, with one long, large, bifid inner cutting point and one small side cutting point.

Jaw not observed.

Helix astur, Souv.

New Caledonia, Mr. Thomas Bland.

Jaw (pl. XX., fig. 11) low, wide, slightly arcuate; ends scarcely attenuated, blunt; anterior surface without ribs; a wide, blunt, median projection to the cutting edge; a line of reënforcement running above, and parallel to, the cutting margin; a strong muscular attachment to the upper margin.

Lingual membrane (pl. XX., fig. 12) with 30—1—30 teeth, with about 9 perfect laterals. Centrals (*a*) with square base of attachment, well-developed side cusps and cutting points; laterals same as centrals, but unsymmetrical as usual; transition to marginals formed as usual (*b*); marginals (*c*) low, wide, with one inner, long, broad, bifid cutting point, and one outer, small cutting point; those figured (*c*) are extremes.

Helix (*Thelidomus*) **auricoma,** Fér.

Lomas de Camoa, Cuba. Mr. Arango to Mr. Bland.

Jaw arched, with blunt, scarcely attenuated ends; 12 broad ribs distributed over the whole anterior surface and denticulating either margin; no median projection to the cutting margin.

Lingual membrane (pl. XXI., fig. 5), with 42—1—42 teeth, of which about 25 may be called laterals, but the change to marginals is hardly marked, these last differing only in being smaller, in having a more square base of attachment, and in having more obtuse and more proportionally developed cutting points; there is no splitting of the inner cutting point of the marginals. The centrals have subobsolete side cusps, but decided side cutting points; the central cusp is short and stout, the base of attachment has greatly expanded lower lateral angles. Laterals like the centrals, but unsymmetrical as usual.

The dentition of this species resembles that of *provisoria* and *notabilis* of the same subgenus.

The genitalia are figured on pl. XIX., fig. 3. The penis sac (*p. s.*) is stout, rounded, with long, pointed apex; the vas deferens (*v. d.*) enters it below the apex; the retractor muscle (*r.*) is inserted in the vas deferens just before it enters the penis sac. The genital bladder (*g. b.*) is short, cylindrical, with blunt end; its duct is short and small. The penis sac enters the vagina opposite the entrance of the genital bladder.

Helix (*Carocolus*) **sagemon,** Beck.

Cuba. Mr. Arango to Mr. T. Bland.

Jaw high, arcuate, ends rapidly but slightly attenuated, blunt; cutting margin with broad, blunt, median projection; no anterior ribs.

Lingual membrane (pl. XXI., fig. 4) very long and narrow, with 36—1—36 teeth, the transverse rows of teeth being unusually oblique. The change from laterals to marginals is so gradual that it is difficult to say how many of the former there are. Centrals with base of attachment long, constricted at the middle, expanded above and with greatly produced lower lateral expansions; reflection large, with obsolete side cusps and no side cutting points, and with a very broad, short median cusp, bearing a short, widely expanded, square cutting edge (as it cannot be called a *point*). Laterals like the centrals, but unsymmetrical as usual, and with an unsymmetrical cutting edge larger than in the central tooth. The cutting edge becomes more developed as the teeth pass off laterally, in proportion to the base of attachment and the cusp also. Thus the marginals become formed without any splitting of the inner cutting point, or any development of a side cusp and cutting point. This is better shown in the figures than can be expressed in words.

The genitalia of this species is figured on pl. XIX., fig. 2. The testicle (*t*) is small and imbedded in the upper lobe of the liver; the epididymis (*ep.*) is long and greatly convoluted near its junction with the oviduct; the accessory gland (*acc.*) is composed of several tubular cæca of unequal length; the ovary (*ov.*) is very large and sabre-shaped; the oviduct (*ovid.*) is narrow, but slightly convoluted; the genital bladder (*g. b.*) is large, globular, with a short, stout duct entering the vagina at about the middle of its length; the penis sac (*p. s.*) is large, with a central constriction, tapering towards the apex, where the vas deferens (*v. d.*) enters, and bearing the insertion of the retractor muscle (*r.*) below its apex; it enters the cloaca close to the external orifice.

Helix (*Caracolus*) **Arangiana, Poey.**

Cuba. Mr. Arango to Mr. Thomas Bland.

Jaw (pl. XXI., fig. 2) greatly arched, ends blunt, scarcely acuminated; anterior surface without ribs; cutting margin with a blunt median projection.

Lingual membrane very long and narrow (pl. XXI., fig. 1), with 33—1—33 teeth, of same type as in *H. sagemon* (see above). The lower edge of the base of attachment appears delicately fringed.

Genitalia as in *H. sagemon* (see above).

Helix (*Pomatia*) **Sieboldtiana, Pfr.**

Japan. Received from Dr. W. D. Hartman.

Jaw high, arched, ends but little attenuated, blunt; anterior surface with eight stout, separated ribs, denticulating either margin; no median projection to the cutting margin.

Lingual membrane long and narrow (pl. XXI., fig. 8); teeth 39—1—39, with 21 perfect laterals; centrals with base of attachment long, narrow, the lower lateral angles somewhat expanded, but blunt; median cusp long, stout, cutting point stout, blunt, not reaching the lower edge of the base of attachment; side cusps obsolete; no side cutting points. Laterals like the centrals, but longer and wider, and unsymmetrical as usual; the fifteenth lateral has a side cutting point. The transition to marginals formed as usual by the greater proportional development and splitting of the cutting point. Marginals low, wide, with one broad, oblique, bluntly bifid cutting point, and one short, side cutting point.

The species is placed by Von Martens in *Acusta*, a subgenus of *Nanina*, judging from shell alone.

Helix convicta, Cox.

Australia. Received from Dr. Cox by Dr. W. D. Hartman.

Jaw high, arcuate, thick; ends but little attenuated, blunt; no median projection to cutting edge; anterior surface with 7 separated, stout ribs.

Lingual membrane (pl. XXI., fig. 7) with 30—1—30 teeth, with 10 laterals. The centrals and inner laterals have no side cutting points. Transition to marginals as usual (see last species). Marginals low, wide, with one short, broad, bifid inner cutting point, and one small, side cutting point.

Helix (*Dorcasia*) **pyrozona,** Phil.

" Outside the great wall of China." Lieut. Wild, U. S. N., to Dr. W. D. Hartman.

Jaw as in Pomatia (see above, *H. Sieboldtiana*). Ribs few, stout.

Lingual membrane (pl. XX., fig. 8), with 28—1—28 teeth, with 10 perfect laterals. It is difficult to distinguish any cutting points on the obsolete side cusps of centrals and inner laterals. The general characters of the teeth are as in *H. Sieboldtiana* (see above).

Stenogyra hasta, Pfr.

Cuba. Received from Mr. Bland.

Jaw (pl. XX., fig. 2) low, arcuate, ends somewhat attenuated, blunt; no median projection to cutting margin; anterior surface with numerous delicate striæ.

Lingual membrane (pl. XX., fig. 3) as usual in the genus (see ante, p. 187). There are 18—1—18 teeth.

The species was formerly described as a *Balea*. This examination of the jaw and dentition shows its correct position to be in *Stenogyra*.

Macroceramus turricula, Pfr.

Lomas de Camoa, Cuba. Mr. Arango to Mr. Bland.

Jaw as usual in the genus (see ante, p. 223). Ribs 35.

Lingual membrane (pl. XX., fig. 9) as in *M. Gossei*, Pfr. (see above), not as in *Cylindrella*.

Cylindrella (*Gongylostoma*) **elegans,** Pfr.

Habana, Cuba. Mr. Arango to Mr. Thomas Bland.

Lingual membrane (pl. XX., fig. 6) with 12—1—12 teeth, arranged as usual in the genus(see ante, p. 222). The base of attachment is shorter and stouter, the outer cusp of the laterals is larger and on a shorter and stouter pedicle than in *Cylindrella scæva*, figured on page 222. There are no distinct marginals, the teeth slightly and gradually changing in size as they pass off laterally, until in the extremes the two cutting points become of almost equal size and the outer one ceases to be on a distinct pedicle; the base of attachment also in the extremes is almost square.

This membrane is of interest, being the first described of the section *Gongylostoma*, whose dentition was unknown to Messrs. Crosse and Fischer.

Cylindrella cyclostoma, Pfr.

Mr. Arango to Mr. Bland. Lomas de Camoa, Cuba.

Jaw as usual in the genus, with over 70 delicate ribs (see ante, p. 222).

Lingual membrane long and narrow, as usual in the genus. Laterals 2, marginals about 8, these and centrals of same type as those figured by Messrs. Fischer and Crosse (Journal de Conchyliologie, 2d s., X.), for the group *Cylindrella*, s. s., as in *Cylindrella costata*, pl. IV., fig. 2.

The first marginal, however, surely is of same type as the laterals, though much smaller and somewhat modified in form. It appears like a transition from the one to the other.

Cylindrella (*Thaumasia*) **Humboldtiana**, Pfr.

Cuba. Mr. Arango to Mr. Bland.

Lingual membrane long and narrow, as usual in the genus. Teeth 8—1—8 of same type as figured by Messrs. Fischer and Crosse for *C. rosea* (Journ. de Conch., XVIII, 1870, pl. IV. fig. 4).

The species belongs, therefore, to their group *Thaumasia*.

The jaw is as usual in the genus, with about 100 ribs.

EXPLANATION OF THE PLATES.

Plate XIX.

t. Testicle.
e. Epididymis.
ac. Accessory gland of last
ov. Ovary.
ovid. Oviduct.

p. Prostate.
v. d. Vas deferens.
p. s. Penis sac.
r. Retractor muscle of last.
or. External orifice of genitalia.
g. b. Genital bladder.
v. Vagina.

Fig. 1. Genitalia of Partula.
Fig. 2. " H. Sagemon, Beck.
Fig. 3. " H. auricoma, Fér.
Fig. 4. Lingual dentition of Partula amanda, Pease. The last figure is the extreme marginal in profile.
Fig. 5. Jaw of Partula.
Fig. 6. " " Partula gracilis, Pease.
Fig. 7. Genitalia of Partula umbilicata, Pease.
Fig. 8. " " P. virginea, Pease.
Fig. 9. " " P. fusca, Pease.
Fig. 10. " " P. bilineata, Pease.
Fig. 11. Jaw of P. virginea, Pease.

Plate XX.

Lingual dentition and jaw of:—
Fig. 1. Nanina subcircula, Mousson.
Fig. 2, 3. Stenogyra hasta, Pfr.
Fig. 4. Helix vortex, Pfr. (See p. 180.)
Fig. 5. Helix septemvolva, Say. (See p. 203.)
Fig. 6. Cylindrella elegans, Pfr.
Fig. 7. Succinea Stretchiana, Bland. (See p. 232.)
Fig. 8. Helix pyrozona, Phil.
Fig. 9. Macroceramus turricula, Pfr.
Fig. 10. Holospira Goldfussi, Pfr. (See p. 183.)
14. The extreme figure is drawn from another portion of the membrane, where the cusps are more highly developed.
Fig. 11, 12. Helix astur, Souv.

Plate XXI.

Jaw and lingual dentition of:—
Fig. 1, 2. Helix Arangiana, Poey.
Fig. 3. Macrocyclis euspira, Pfr.

Fig. 4. Helix Sagemon, Beck.
Fig. 5. Helix auricoma, Fér.
Fig. 6. Endodonta tumuloides, Garrett.
Fig. 7. Helix convicta, Cox.
Fig. 8. Helix Sieboldtiana, Pfr.
Fig. 9. Zonites minusculus, Binney. (See p. 166.)

May 4.

The President, Dr. Ruschenberger, in the chair.

Twenty-one members present.

On an Indian Kitchenmidden.—Prof. Cope exhibited a collection of animal remains and fragments of pottery, flint arrow-heads, etc., taken from an Indian kitchenmidden, in Charles County, Maryland, by Oliver Norris Bryan. He stated that the animal fragments included the bones of seventeen species of vertebrata, and two of shells. Of the vertebrates, four are mammals, two birds, four reptiles, and seven fishes. The mammals are the Virginia deer, the raccoon, the gray squirrel, and the opossum. The bones of the Virginia deer are very numerous, and most of them had been split into pieces lengthwise for the purpose of extracting the marrow. Many portions of bones from all parts of the skeleton were preserved, including portions of bones. Of the raccoon three mandibular rami occur, with two of the squirrel, and one of the opossum.

The birds are represented by a number of parts of the turkey and the tarsometatarse of some natatorial bird of the size of a widgeon. The reptiles are all turtles, and include the snapper, the box tortoise, and two emydes, one the *Malaclemmys palustris*, the other probably the *Pseudemys rugosa*. Of fishes there are dermal bones of sturgeons, various parts of the skeleton of the gar (*Lepidosteus crassus*), and numerous bones of Siluroids of at least two species. The larger of these has the pectoral spine strongly pectinated. The smaller exhibits only an obsolete pectination of the same. They are probably *Amiurus lophius*, Cope, and *A. lynx*, Gird., respectively. There is a preoperculum of a cycloid fish, perhaps a cyprinoid, and another preoperculum with spiniferous border, belonging to some brackish water or anadromous percoid. Numerous interneural and fin pieces indicate the Rock-fish (*Roccus lineatus*). The mollusks are *Unio purpureus* and *Mesodon albolabris*.

May 11.

The President, Dr. Ruschenberger, in the chair.

Twenty-three members present.

On fossil Lemurs and Dogs.—Prof. Cope described a new genus of lemurs from the eocene deposits of the Rocky Mountains, stating that it belonged to the type which he had originally shown to have relations with the *Procyonidæ* and other related low forms of *Carnivora*. It was characterized as follows: Molars 4—3, the last with heel; crowns of true molars of four opposite or slightly alternating tubercles, the external pair slightly crescentic in sections; anterior inner tubercle bifid. The premolars are compressed, the last acute and with an acute inner tubercle. This form differs from *Pantolestes*, Cope, in the presence of the inner cusp of the fourth premolar, and from *Tomitherium*, Cope, in the double or bifid anterior inner tubercle of the true molars. From *Anaptomorphus*, Cope, many details of its molar teeth distinguish it. He named the genus *Sarcolemur*, and gave as the type *S. furcatus* (*Antiacodon furcatus*, Cope; Ann. Rept. U. S. Geological Surv. Terrs., 1872, p. 608); other species are the *S. pygmaeus*, Cope (l. c. p. 607); and *S. mentalis*, Cope (*Systematic Catal. Vert. New Mexico*, 1875, p. 17). He added that the genus *Menotherium*, Cope, the only quadrumanous form certainly known from the Miocene beds of the west, had apparently been redescribed by Marsh under the name of *Laopithecus*.

Prof. Cope exhibited the mandibular ramus of a new species of dog of large size, which he had discovered in one of the Pliocene formations of the west. It is considerably larger than the wolf, and similar in size to the *Amphicyon haydenii* (*Canis haydenii*, Leidy); and may belong to the genus *Amphicyon*. It is distinguished for the large size of the tubercular molars and canine teeth, and the small size of its premolar teeth. The premolars are separated from each other and from the canine by short subequal diastemata, but the fourth premolar and the true molars form an uninterrupted series. The first tubercular molar is larger than the last premolar, and the second tubercular is but little smaller than the same tooth, and has its single flat root so grooved as to foreshadow the two rooted condition seen in the *A. haydenii*. The mandibular ramus is deepened posteriorly, and is remarkable in the great anterior prolongation of the masseteric fossa, which reaches as far as below the middle of the sectorial molar tooth. The dimensions are as follows: Length of molar series from alveolus of canine M. .121; length from same to sectorial molar, .061; length of sectorial, .031; width of do., .015; length of first tubercular, .020; width of crown of do., .012; depth of ramus at posterior border of do., .055; depth of ramus at anterior border of sectorial, .049; depth of do. at first or simple premolar, .038; long diameter of canine tooth, .023. From *A. haydenii* the species differs in the position of the tubercular molars being on the continuous alveolar border as in typical dogs, in the one rooted second tubercular tooth, and in the anterior extension of the masseteric fossa. The species was named *Canis ursinus*.

MAY 18.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-seven members present.

On the Antelope-Deer of the Santa Fe Marls.—Prof. COPE exhibited specimens of the dentition, horns, etc., of the antelope-deer found by the paleontologist of the Wheeler survey of New Mexico. He coincided with Prof. Gervais' view that the oldest name for the genus is *Dicrocerus*, Lartet, of which the *D. dichotomus* of the French Miocene is type. The American species are *D. necatus*, Leidy (*Merycodus*, Leidy; *Cervus warrenii*, Leidy); *D. furcatus*, Leidy; (*Antilope* and *Cosoryx*, Leidy); *D. ramosus*, Cope; *D. gemmifer*, Cope (*Merycodus*, Cope); and *D. teres*, Cope. The specimens proved that some specimens of a species exhibit the horns continuous with the frontal bones, while others of the same had been broken off and anchylosed, with the production of a small burr.

He added that the facies of the fauna of this horizon throughout the west, including, as it does, *Amphicyon*, *Dicrocerus*, *Hippotherium*, *Aceratherium*, *Mastodon* allied to *M. angustidens*, etc. etc., more nearly resembles the upper Miocene of Europe than the Pliocene of that continent.

MAY 25.

The President, Dr. RUSCHENBERGER, in the chair.

Nineteen members present.

Charles Sumner Williamson, Dr. John M. M'Grath, J. Warner Edwards, F. Oden Horstman, William Williamson, M. B., Wm. G. Platt, Miss Mary Jeanes, and Miss Anna T. Jeanes were elected members.

Dr. John Belisario of Sydney, N. S. W., was elected a correspondent.

JUNE 1.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-one members present.

A paper entitled "A Critical Review of the North American Saccomyidæ," by Elliott Coues, U. S. A., was offered for publication.

On some new fossil Ungulata.—Prof. COPE exhibited specimens of the following ungulates, found by himself in New Mexico, while acting as geologist to the United States Survey under Lieut. G. M. Wheeler, U. S. E.

PLIAUCHENIA HUMPHRESIANA, Cope, gen. et sp. nov.

Char. gen. Represented in the collection of the expedition by a left mandibular ramus which includes alveolæ of all the teeth, and greater or less portions of all the molars except the last, and the first premolar. In the specimen the dental formula is I.? C. 1; P.m. 3; M. 4; or one premolar less than in *Procamelus*, and two more than in *Auchenia*. On this ground the present animal is regarded as representing a new genus of *Camelidæ*, intermediate between the genera named. A portion of the left maxillary bone of a larger species is thought to belong to the same genus, although it presents the number of premolars found in *Procamelus*, viz., four. The first and second are, however, very close together, so as to leave about the same relative interval between the first and third as is seen in the *P. humphresiana*, should the second premolar be omitted. The latter tooth is wanting from the lower jaw of the *P. humphresiana*. The difference in dental formula between the superior and inferior dental series admitted provisionally in *Pliauchenia*, finds justification in the formula of the llamas (*Auchenia*), where the premolars are $\frac{2}{1}$.

Char. specif. The animal now described is of about the size of the *Procamelus occidentalis*, or somewhat larger than any of the existing llamas. The mandible is stout and deep, contracting rapidly forwards. The canine and first premolar are especially stout, and separated by a very short diastema; that separating the first and third premolars is also short, being less than that which separates the first and second in *Procamelus occidentalis;* could it be supposed that the second premolar is abnormally absent from the *P. humphresiana*, the diastema would be reduced to a very small compass. Without this supposition the diastemata, both before and behind the first premolar, are shorter than in any of the *Procameli*, as *P. robustus*, *P. angustidens*, *P. heterodontus*, and *P. gracilis*. The mental foramen issues below the anterior border of the first or caniniform premolar, and the anterior border of the latter marks the posterior margin of the symphyseal suture. The third premolar is nearly as long as, but narrower than the fourth, and the true molars increase rapidly in size posteriorly.

Measurements.	M.
Length of dental series from front of canine to front of last molar	.125
Length from canine to P. m. No. 1	.010
Long diameter of first premolar	.010
Diastema to third premolar	.023
Length of third premolar	.011
" " first true molar	.019
Width of crown of first true molar	.011
Length of crown of second true molar	.025

This species is dedicated to General A. A. Humphreys, Chief of the Topographical Engineers, in recognition of the enlightened interest in all departments of scientific investigation, exhibited in his long and able administration.

PLIAUCHENIA VULCANORUM, Cope, sp. nov.

Represented by the left maxillary bone of a camel of about the size of the existing dromedary, and considerably larger than the species last described. The dental formula is, molars 4—3. The first premolar is only removed from the second by a diastema equal to the long diameter of the latter. The latter has no inner cingulum, while in the third it is so strong as to constitute an internal crescent. The third is much larger, and exhibits the usual single external and single internal crescents. The first molar is stout, long rooted, and furnished with a strong ridge on the outer side, bounding the posterior crescent-bearing column in front. There is a weak ridge on the middle of the anterior column, and only a rudiment on the last premolar. There are no cingula on either the inner or outer bases of the crown. The enamel is nearly smooth. A palato-maxillary foramen issues opposite the anterior border of the base of the third premolar.

Measurements.	M.
Length from posterior border of first premolar to posterior border of first molar	.090
Length of first true molar	.030
Width of basis of crown of first true molar	.024
Length of fourth premolar	.019
Width of base of crown of fourth premolar	.018
" " palate at first true molar	.040

The typical specimen was found near Pojuaque, a village of the Pueblo Indians. Various bones of camels of the size of the *P. vulcanorum* were also found, some of which doubtless belong to it.

HIPPOTHERIUM CALAMARIUM, Cope, sp. nov.

This three-toed horse is indicated by the oral and palatine parts of the skull with the superior dental series of both sides, together with one mandibular ramus with all its teeth, of an individual from near San Ildefonso; and also probably by molar teeth of two individuals from the Loup Fork beds of Colorado. The species is allied to the *H. paniense*, Cope, and differs from the *H. occidentale*, *H. speciosum*, and *H. gratum* of Leidy, in the relative form and size of the interior dentinal column. In the two species first named, this column is subcylindric and equal to or smaller than the posterior internal columnar fold; in the three species last named the anterior column is flattened or oval in section, and often larger than the posterior columnar fold, and submedian in position.

In the typical or New Mexican specimen the interior column is large, and its centre is anterior to the middle transverse line of the crown. In the present state of attrition, which has left two-thirds of the crowns of the median molars, this column presents an angular projection towards the inner anterior crescent, betraying an approach to the union seen in *Protohippus*, which is in the fifth molar of the right side of the present horse, actually accomplished through the medium of a narrow isthmus. The dentinal band, connecting the inner crescents, throws out two, rarely one, fold towards this column. The borders of the lakes are much plicate, the posterior border of the anterior lake having from four to six inflections. The posterior border of the posterior lake exhibits one deep inflection, which is generally bifurcate.

The first premolar is quite small, and is two-rooted; the second is a wide tooth, different in form from the elongate corresponding tooth of the *H. occidentale*, its anterior lobe being but little prominent. The palate is wide and well arched. The mandibular teeth are elongate, but not narrow, and the interior lobes are well developed, especially the median ones. No basal cingula on teeth of either jaw. The last molar is smaller than the three preceding it, and the anterior lobe of the first is quite narrow.

The molars of one of the specimens from Colorado are closely similar in all respects, except that the anterior lobe of the second premolar is a little more produced. I also refer here the tooth described as "No. 2," under *H. paniense*, in Report U. S. Geol. Survey, Terrs. 1873, p. 522–3. As compared with the molars of that species those of *H. calamarium* differ in the much greater complexity of the enamel folds, those of the *H. paniense* being the simplest in the genus, even more so than in *H. affine*. The anterior inner column of *H. paniense* lacks the characteristic inner angle seen in the present horse.

Measurements.	M.
Length of seven superior molars	.134
" " three true molars	.062
" " second premolar	.026
Width of crown of second premolar	.020
Greatest length of second premolar	.022
" width " " "	.024
" length " penultimate molar	.022
" width " " "	.022
Width of palate (chord) between middle of third premolars	.042
Length crown antepenultimate lower molar	.021
Width " " " "	.012

The typical specimen belongs to an adult animal, and was taken from the matrix by myself without admixture of others.

APHELOPS JEMEZANUS, Cope, sp. nov.

That a second species of rhinoceros, even larger than the other species of *Aphelops*, formerly existed in the region of New Mexico, is demonstrated by a right mandibular ramus obtained by Dr. H. C. Yarrow, from near the town of Santa Clara, on the west side of the Rio Grande. The specimen in its present condition includes the condyle, angle, and ramus as far as the last premolar, and supports the three true molars. The latter are worn, indicating the full age of the animal. They still retain the enamel surface of the sinus between the posterior and median transverse crests, and the lower end of the sharp inner margin of the anterior transverse crest.

While the ramus exhibits the compressed form seen in *A. megalodus* and *A. meridianus*, it differs from these and the *A. crassus* in many striking respects. Thus the inferior margin near the angle does not exhibit the protuberance and following contradiction of the inner side seen in the first two species. In another feature it differs from all the other species, *i. e.*, in the form of the ascending ramus. This rises very gradually from the basis of the last molar, leaving a subhorizontal edentulous space behind the latter as long as the second true molar. Its anterior face, instead of being flat and bounded by strong, lateral, angular ridges, as is the case in *A. crassus* and the two other species, is rather narrowly convex. Instead of the usual ridge of the outer side, the anterior border of the area of insertion of the masseter muscle is marked by a permanent curved protuberant margin, which is wanting in the three other species, the surface in them being plane. Behind the condyle is seen the tuberosity characteristic of the Rhinoceridæ. The internal pterygoid fossa is well marked. Rugosities for insertion on the lower border of the angle are strong.

The relations of the dentition of this species are also peculiar. The last molar is nearly half as large again as that of specimens of *A. megalodus*, and *A. meridianus* of similar dimensions of ramus, and the teeth diminish in length anteriorly more rapidly than in width. Thus, while the first true molar is as long as in the two species named, the width is between one-half and one-third greater. There are no external basal cingula.

Measurements.	M.
Length of ramus from fourth premolar (behind) to middle of masseteric fossa	.240
Length of series of true molars	.148
" " first true molar	.044
Width " " " "	.033
Length " third " "	.058
Width " " " "	.035
Diameter of ramus at first molar	.080
Depth of ramus of third "	.092

The Phylogeny of the Camels.—Prof. Cope made the following remarks on the extinct genera of camels :—

The line of descent of the horses has been already largely traced by several paleontologists ; another series may now be regarded as partially completed, viz., that of the camels. I have already indicated the antecedent relation in which the miocene genus *Poëbrotherium* stands to the existing camels in the structure of the limbs and teeth, as well as the intermediate position occupied by *Procamelus* in the existence of the incisor teeth. It now remains to point out the relations determined by the structure of the feet in *Procamelus* and the dentition in *Pliauchenia*, a new genus discovered in the Loup Fork beds of New Mexico. Commencing with the earliest genus, *Poëbrotherium*, we have the molar teeth 4—3, as in the primitive mammalia generally. There are but two elongated metacarpals, which are not united into a cannon bone, the lateral ones being rudimental, while the carpals are of the number characteristic of the mammalia of all the orders with numerous toes, namely, seven. In *Procamelus* of the succeeding formation, the molar formula continues to be 4—3, but the posterior teeth are more prismatic in form than in the miocene genus. The incisor teeth are present, thus displaying the primitive character of the class generally; though as these teeth are early shed, an approximation to the edentulous condition of existing ruminants in this part of the mouth is apparent. In the feet, the approximation to the existing *Camelidæ* is greater than in the dentition. Thus the lateral rudimental metacarpals of *Poëbrotherium* have disappeared, and with them the trapezoides of the carpus. The magnum remains distinct, while the middle metacarpals are united at full age into a cannon bone. In the contemporary genus *Pliauchenia*, a further modification of dentition is observed. As above stated, the molars of *Procamelus* number $\frac{4}{4}$—$\frac{3}{3}$; in *Camelus* they number $\frac{3}{2}$—$\frac{3}{3}$; in *Pliauchenia* we have the intermediate condition ?$\frac{4}{3}$—$\frac{3}{3}$. The end of the series is seen in *Anchenia*, where the formula is $\frac{2}{1}$—$\frac{3}{3}$.

It has been observed as a remarkable fact, that North America should present us with the most complete history of the succession of genera which resulted in the horse, and yet should have received this animal by importation from Europe. Nevertheless the more prominent genera of this series have been obtained in the European formations; especially *Anchitherium* and *Hippotherium*. But as regards the *Camelidæ*, the genera above described are exclusively North American; no well-determined form of this group having been found in any formation of the Palæarctic region up to the present time. Until such are discovered, there will be much ground for supposing that the camels of the old world were derived from American ancestors; while the presence of the llamas in the existing South American fauna, indicates the absence there of the conditions which caused their extermination from North America.

Living Organisms in the Pulp Cavity of Teeth.—Mr. C. N. Peirce remarked that, in making some investigations on the organisms found within the oral cavity, he noticed what might be deemed of some importance to those interested in studying the "Beginnings of Life." It is not an infrequent occurrence for the pulp, or nerve and accompanying vessels, within the tooth to become devitalized without any loss of the hard tissues from dental caries or otherwise. The loss of vitality and necessary disintegration of this peculiarly vascular tissue, results invariable in the formation of pus and gas.

Upon opening into several such cavities they were, as is usual, found to be extremely offensive from this degenerated matter. On examining this putrid material with the microscope, living organisms, resembling what have been described and figured as *Bacteria* and *Vibrios*, were observed in large numbers. Their presence in these cavities, secluded as they were from any contact with the atmospheric air or secretions of the mouth, must be accounted for in one of two ways, viz.: The embryonic germs of these organisms must be universally disseminated, not only throughout this vascular tissue, but also the various textures of the body, by means of the circulating fluid, there to develop and manifest themselves whenever these higher tissues are on the eve of death and degeneration—or else it must be that when the vitality of this vascular tissue is on the wane, its constituent particles are capable of individualizing themselves and of growing into the low organisms in question.

JUNE 8.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-five members present.

On Samarskite.—JOSEPH WILLCOX called attention to a mineral specimen (samarskite) presented by him, which was found at a locality discovered by him recently among the mountains in Mitchel Co., North Carolina. Excepting in North Carolina, this rare mineral is only found in the Ural Mountains in Asia. According to Dana's Mineralogy, the largest specimens found at the latter locality are only as large as hazel-nuts; but Mr. Willcox said he obtained a specimen in North Carolina that weighs more than twenty pounds. It was associated with decomposed feldspar.

The Geology of New Mexico.—Prof. COPE stated that the ground covered by the geological investigation conducted mainly in New Mexico during 1874 in connection with the Wheeler U. S. topographical and geological survey, embraces the eastern slope of the Rocky Mountains from Pueblo to the Sangre de Christo Pass; both sides of the Rio Grande Valley from that point to Algodones, N. M.; the western or Sierra Madre range, and the country for forty miles to the westward of it, from the latitude of Sierra Amarilla as far south as the road from Santa Fé to Fort Wingate.

Little of novelty has been added from the first two named regions, as they have been previously traversed by competent geologists; but the last named has remained up to the present time almost unknown. The analysis of the structure of the Sierra Madre range is believed to indicate that its elevation took place near the close of the period known as Cretaceous No. 4, and that the elevating force was in New Mexico, more powerful at its southern extremity than along the middle portions of its line. Another important discovery is the lacustrine character of the triassic beds which form a part of the axis of the range; indicating the existence of extensive areas of dry land at that period, of which no portion is remaining in the region examined by me, but which may be supposed to be represented by the palæozoic beds further south and west. A third important point is the determination that the plateau drained by the eastern tributaries of the San Juan River is composed of the sediment of an extensive lake of Eocene age, which was probably at one time of great extent, but whose deposits have been greatly reduced in extent through erosion. The boundaries of this lake to the east and south were determined.

It is believed that additional light has been thrown on the question of the age of the Galisteo sandstone; and that its paleontology has decided definitely that of the Santa Fé marls. The first fossils discovered in the "trias" of the Rocky Mountains, have enabled me to reach more definite conclusions as to its position in the scale of periods.

The remains of vertebrata obtained from the latter formation are those of fishes and reptiles. The former are rhomboganoid scales of small species which are numerous in the coprolites of the reptiles; the latter represent the three orders of *Crocodiles*, *Dinosauria*, and apparently of *Sauropterygia*. The dinosaurian order is represented by a part of the crown of a tooth of a species of large size, of the general character of *Laelaps*. Both faces are convex, the one more so than the other, and the long axis of the crown is curved towards the less convex side. Both cutting edges are sharply and closely crenate denticulate as in *Laelaps*, *Aublysodon*, etc.; otherwise the enamel is perfectly smooth. There was not enough of this animal discovered to enable me to identify it. The suspected sauropterygian species is represented by a single vertebra with the centrum slightly depressed, circular section, and about as long as wide. The neurapophysis appears to have been united by suture, although this point is not so clear as desirable, and the bases of the diapophysis are very stout, extending the entire length of the upper half of the lateral surface of the centrum. Of the articular faces, one is much more concave than the other. Length of centrum, m. .05; width, .057; depth, .055. The crocodilian remains consist of a portion of a jawbone with alveoli for four teeth, of a broken vertebra, and a number of dermal-scuta and fragments of other bones. At another locality not far distant, were found numerous remains of saurian bones, embracing dermal and cranial pieces, coprolites, a fragmentary tooth, etc., which may have some affinity to these. The species indicated by the former may be named and described as follows:—

TYPOTHORAX COCCINARUM, Cope, genus et species nova.

Character genericus. The fragment of jaw belonging to this genus is probably maxillary in position, for the following reasons: the interior face of the bone is sutural, and for the most part solid. This would refer it to the position of the symphyseal portion of the dentary bone of a gavial-like form, but for other considerations. Supposing the piece to be dentary, and the suture therefore vertical, the incongruity follows that the alveolar face becomes very steep, so much so as to prevent the interlocking of the teeth, which become lateral in position. If, however, the jaw fragment be reversed in position, and the alveolar face placed in a horizontal position, the suture of the inner side forms a sharp angle with the vertical plane, as it should on the supposition of its being the maxillary bone. The wedged-shaped section necessary to fill the space between it and the median plane, will then be that of the prolonged posterior spine of the premaxillary bone. The solidity of this portion of the muzzle is inconsistent with the gavial genera of the Jura and later times, but not with the structure of the triassic Belodons. The posterior part of the inner face is, however, strongly excavated, and the sutural margin exhibits an outward deflection, which is either the boundary of the nostril, or the suture for the apex of the prefrontal or nasal bone. In either case the nasal cavity and the nostril are posterior in position in conformity with the structure of the "thecodont" crocodilia. The alveoli are large and arranged in a curved line, one of them somewhat exterior in position and isolated by a short diastema like a canine. Surface of the bone pitted. The dermal scuta found close to the jaw fragment have a flat upper surface marked with shallow pits rather closely placed, having resemblance to an obsolete Trionyx sculpture. Near one of the margins of the bone, the pits run out in shallow grooves. A portion of a vertebral centrum found with the jaw exhibits one articular face; this is shallow, concave, of the type of the Amphicoelian division of *Crocodilia.* The body of the centrum is much compressed.

The other remains include a portion of a dermal bone like those described, and the crown of a tooth among other fragments. This crown, which has lost most of its enamel, is triangular in section, and somewhat curved in its long axis. A convex face is directed forwards and outward (on the supposition that the tooth is superior), and a nearly plane face posteriorly. The inner face is worn flat by the attrition of an opposing tooth. The pulp-cavity is minute or wanting.

Char. specif. The pitting of the maxillary bone is not linear, and is sometimes round; it is rather remote. The outside of the bone is steep, indicating that the muzzle is not depressed. Its face is swollen opposite the supposed canine tooth. The alveolæ are round, and longitudinally oval. The alveolar face is decurved near the end of the muzzle. The superficial layer of the cranial and dermal bones is dense and fine grained. The second series of specimens, whose reference is by no means certain, but which contains a dermal bone like that of the type, includes fragments apparently of the upper surface of the cranium. This is marked with irregular tuberosities and excavations resembling that seen in the Belodonts of the Carolinian and Würtembergian Trias. A section of a narrow dermal bone displays an elevated obtuse median keel, the only bone which displays this form in the collection, the usual form being either flat or slightly concave. Accompanying the same, are numerous coprolites, which are apparently too small for an animal of the dimensions of the type specimen. They are slender, and display rectal folds, which do not exhibit a continuous spiral. They are found, wherever fractured, to be filled with the rhomboganoid scales of some small fish.

Measurements.		M.
Length of fragment of maxillary		.095
Depth (oblique) at ? nostril		.050
Depth (vertical) "		.045
Width (median) "		.025
Width at front alveolus		.035
Diameter canine alveolus		.015
Diameter of another alveolus		.011
Diameter centrum (? caudal) vertebra	transverse	.024
	vertical	.022
Thickness of dermal shield		.008
Measurement across four fossæ of do.		.020
Diameter of crown of tooth No. 2		.018
Length of coprolite of No. 2		.045
Diameter " "		.011

The flat and regularly pitted dermal bones distinguish this genus from *Belodon*. The species was of large size, the cranial fragments equalling corresponding portions of the Gangetic gavial.

The evidence derived from the *Typothorax coccinarum* is favorable to the identification of this horizon with that of the Trias, although it cannot of course be regarded as conclusive, until more perfect specimens are obtained.

Besides the overlying sandstone bed, the red marls are traversed below it by a conglomerate, which is in some places of a bluish tint. At some points it weathers to gravel, and near this horizon the vertebrate remains occur.

In review I give the following section of the Eocene rocks of the region west of the Sierra Madre range:—

Red and gray marls	Wahsatch Group	1500
Sandstone		1000
Green and black marls—Puerco group		500
		3000

The following is an approximate estimate of the mesozoic beds in the same region; as they were not accurately measured, the numbers will have to undergo revision; their relative thickness is nearly as given:—

Uncertain (concealed in the sage plain)	500
Cretaceous No. 4	1500
Cretaceous No. 3	400
Cretaceous No. 2	1500
Cretaceous No. 1	500
Jurassic	600
"Trias" (bottom not seen)	1000
Total	6000

The mesozoic beds of this section (excepting some of the higher members of the cretaceous) have been examined over extensive areas to the west and south, by Messrs. Marcou and Newberry, whose valuable reports accompany those of Lieutenants Whipple and Ives, on the routes surveyed by them through Arizona and New Mexico. The horizon here termed, after Hayden, "Triassic," has been referred to this formation by Marcou also, who had the opportunity of examining it in Texas and the Indian Territory. So far as the latter region is concerned, I can confirm the identification, having examined bones from the red beds of that country, which appear to be those of Belodonts. Dr. Newberry terms it, in Arizona, the "salt group," or "saliferous sandstones," referring to it as probably including both Triassic and Permian strata.

The formations here called jurassic are partially included by Marcou in his triassic series; and are termed the "variegated marls" by Dr. Newberry, who is inclined to refer them to the jurassic.

Dr. LeConte inquired, at what line of latitude the observations of Mr. Cope had been made. Mr. Cope replied that the section was made at about the 36th degree.

Dr. LeConte then remarked that the observations of Mr. Cope, with a single exception of the locality of fossils mentioned, which was new, confirmed entirely the observations made by himself in 1867; the arrangement of the older beds further south was, however, less simple than that indicated on the blackboard by Mr. Cope. Underneath the red triassic beds mentioned by Mr. Cope was a very thick bed of hard, white sandstone of Permian age, which bore a deceptive resemblance to Cretaceous No. 1, but which along the Pecos River contained an abundance of *Calamites*, and other characteristic plants. Below this white sandstone was a large mass of deep-red sandrock containing fossil shells badly preserved and lying upon the carboniferous limestone, which had been seen by Mr. Cope.

These facts all went to establish the view expressed by Dr. LeConte in his report in 1867, viz.: the greater complication of the older formations to the south and west, of the intercontinental gulf which in previous geological periods divided the Chippewyan from the Appalachian subcontinent.

Corresponding to this, the older rocks became more simple towards the north, while the subdivisions of the newer formations were greatly increased in number, as the gulf became gradually shallower and was converted finally into a fresh-water lacustrine region.

June 15.

The President, Dr. Ruschenberger, in the chair.

Twenty-two members present.

Fruiting of double Peaches.—Mr. Meehan exhibited some branches of peach, in which the young fruit were in twos and threes from one flower. They were from the Chinese double-flowering kind. He remarked that, as is well known, plants with double flowers were rarely fertile. Either the stamens were wholly changed to petals, or the less vital conditions which always accompanied this floral state, were unequal to the task of producing perfect pistils. Vitality, however, was more or less affected by external conditions, independently of the mere structure of organs, and this was well illustrated by the remarkable fertility of the peach this season. Usually large numbers of fruit fell without "setting," as it is technically called by orchardists, not because there was any defect in the organs of reproduction, but from lack of vital force to accomplish so much. This season many more had continued, than had been known for many years, and the prospect was for an immense crop of fruit. This abounding vitality had evidently extended to the double peaches, and had influenced the development of the female organs to an unusual extent.

The facts had an interest in botanical classification. The late Professor Lindley had removed the cherry, plum, peach and allies, from Rosaceæ, chiefly because they had but a single, free carpel, and had grouped them as Drupaceæ.

The production of two and three carpels in this case showed the true relation, and might be of use to those interested in "theories of descent."

Insectivorous Sarracenias.—Mr. THOMAS MEEHAN presented some specimens of Sarracenia variolaris, sent by Dr. Mellichamp, of South Carolina, through Col. J. D. Kurtz, illustrating observations on the supposed insectivorous character of this plant, made by him, and read by Professor Asa Gray at the Hartford meeting of the American Association for the Advancement of Science. Mr. M. said that the fact that insects were caught and drowned in the liquid secreted in these pitchers and were secured on other parts of the so-called fly-catching plants, had long ago been discovered. The novelty in the modern phase of the discussion was that these plants had assumed or developed these trap-like organs, in obedience to a sort of innate instinct, for the express purpose of catching insects and applying them to the nutrition of the plant. In the case of these Sarracenias, Dr. Mellichamp had discovered that a honeyed secretion exuded from the rim of the pitcher and had formed a little stream down the outside, for the purpose, as was assumed, of enticing insects on to their destruction. This was shown on the specimens presented, as were the remains of numerous insects in some of them. Mr. M. remarked that this intentional adoption of means to an end had received the assent of many leading men, but that good objections had been made by some, and the point he regarded as by no means settled. That the insects caught were rapidly decomposed, was undoubted, but it was not so clear that the plant derived any benefit from the decomposition.

Prof. COPE stated that a report furnished to the Academy of remarks made at its last meeting contained the following language: "Dr. Le Conte then remarked that the observations of Mr. Cope, with a single exception of the locality of fossils mentioned, which was new, confirmed entirely the observations made by himself in 1867," etc. This statement implies that the geological description of the region given by him (Prof. Cope) was not new, and the inference follows the language that Dr. Le Conte had previously determined the facts in the case. Prof. Cope stated, in order to correct these inferences, that no published account of the geology of that large portion of New Mexico was in existence prior to the appearance of his own, and that Dr. Le Conte's observations were made on a line whose nearest point of approach to the region described by him is about eighty miles distant, and on the opposite side of the valley of the Rio Grande. He thought that this brief statement of the facts would correct any misapprehension on the part of persons not familiar with the history of the western geological surveys.

JUNE 22.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-three members present.

The Relation of Light to Stomata.—Mr. THOMAS MEEHAN exhibited a leaf taken from a small tree of *Acer pseudo-platanus*—the common sycamore maple—which had assumed an inverted position. The tree was three years old from seed, and all the leaves were of that character. The young leaves first appeared in their normal condition, but as the petiole lengthened, the leaf blade bent under, so that the under surface was exposed to the full sunlight, and under the petiole above. He also exhibited a young oak from an acorn sown in the spring, and which he believed to be *Quercus Catesbæi*, and in which all the leaves were vertical, and not with their surfaces on a plane with the horizon, as is the case with all other seedling oaks and American trees. He said it was possible this position of the leaves was not continued with the increased age of the tree, or it would have been observed and placed on record. Of several hundred young plants all had the same character.

The facts were simple in themselves, but had great interest to the student in vegetable physiology. The stomata were usually on the under side of the leaf, and believed to be there of a necessity. Our leading botanical text book taught that stomata were breathing pores, and could not carry on their essential operations when exposed to direct sunlight; and the same high authority had suggested that if leaves of this character could be inverted, and forced to remain in this condition, the plant would inevitably die. The maple did not die, but had been during all its existence as healthy as others of the same species growing near it. A large number of the proteaceous and myrtaceous plants of South Africa and Australia, and of which the now famous *Eucalyptus globulus* is a familiar example, had their leaves vertical, as in this oak. This had been accounted for by the statement that these leaves had stomata on both surfaces of the leaf, and the effort of these stomata to face the earth had of course resulted in an even balance of power, in which neither side had any advantage. The stomata on each side of the leaf had to face the horizon. Supposing this might account for the position of these oak leaves, they, as well as the maple, had been examined microscopically by Dr. Hunt, of the Academy, and found to have stomata only on one—the normal side. He thought it safe to conclude from these facts, that the accepted theories of the relation of stomata to light required some modification.

JUNE 29.

The President, Dr. RUSCHENBERGER, in the chair.

Sixteen members present.

The resignation of William M. Wilson as a member was read and accepted.

On an Extinct Vulturine Bird.—Prof. COPE exhibited the fossilized skeleton of a vulturine bird of prey from the marls of the Loup Fork Epoch, near Santa Fe, which had been described as *Cathartes umbrosus*, Cope. The beak had been broken off at the base, and the fractured surface did not display the septum characteristic of the true vultures. On removing the matrix from the nostrils Prof. Cope had discovered that the osseous septum is present but short, hence the species must be referred to the vulturine division of the *Falconidæ*, and not to the *Cathartidæ*, and the species called *Vultur umbrosus;* it was about as large as the "king vulture" (*Cathartes papa*) of Mexico. The true vultures do not exist at present in the western hemisphere, and the present determination adds one more old world type to the extinct fauna of the United States. The genus *Vultur* is now associated in Africa and India with *Rhinoceros*, camels, horses, etc. as in the period of the late tertiary in New Mexico.

Isaac R. Hinckley was elected a member. Prof. Luigi Bombecci Porta, of Bologna, and Prof. Paolo Mantovanni, of Rome, were elected correspondents.

The committee to which it had been referred recommended the following paper to be published:—

A CRITICAL REVIEW OF THE NORTH AMERICAN SACCOMYIDÆ.

BY DR. ELLIOTT COUES, U. S. A.

The small group of Rodents to be here treated consists of the genera *Saccomys*, *Heteromys*, *Dipodomys*, *Cricetodipus*, and *Perognathus*.[1] The animals are confined to North and Middle America and the West Indies. They are immediately recognized by the presence of ample cheek pouches, opening exteriorly and lined with fur, in connection with their general murine aspect—for the *Geomidæ* (*Geomys* and *Thomomys*), the only other rodents which have the same kind of cheek pouches, have an arvicoline contour, and are altogether different in external appearance.

This group appears to have been first put together—at any rate it was first satisfactorily defined—in 1857, by Professor Baird, who made it a subfamily (*Saccomyinæ*) of *Geomyidæ*. This sagacious naturalist seems to have been the first to perceive and act upon the really very close affinities subsisting between the *Saccomyidæ* and *Geomyidæ*, which had previously been widely separated in the system; but, in recognizing these relationships, he was led to the length of uniting the two groups as one family. As I have already shown,[2] the curiously different *shape* of the *Geomyidæ* and *Saccomyidæ*, which is of course only a matter of secondary consequence, is co-ordinated with structural characters of prime importance, fully warranting the erection of the *Saccomyinæ* into a family *Saccomyidæ*, distinct from, though unquestionably standing next to, the *Geomyidæ*.

We may consider that this fact was effectually, though only incidentally, exhibited in 1868, by Dr. J. E. Gray, in his "Synopsis of the Species of Saccomyidæ, or Pouched Mice, in the Collection of the British Museum." (P. Z. S. 1868, pp. 199–206.) Though using a terminology indicative of a subfamily ("Saccomyinæ"), this author speaks of "the family" of Pouched Mice.

In his "Arrangement of the Families of Mammals," 1872, Dr. Gill first formally catalogues a family *Saccomyidæ*, equivalent

[1] *Abromys*, Gray, P. Z. S. 1868, 202, is not included, because the diagnosis is insufficient for its recognition. It is probably *Perognathus*.

[2] Bulletin U. S. Geol. and Geogr. Survey of the Territories (Hayden's), second series, No. 1, 1875, pp. —.

to the *Saccomyinæ* of Baird, 1857, and of Gray, 1868, which is placed next to the *Geomyidæ*, with which it constitutes one of this author's numerous taxonomic refinements, namely, a "super-family" *Saccomyoidea*. These groups, however, are merely named, no characters being furnished for their recognition. Use of the term "Saccomyoidea" seems to me to be one way of expressing the undoubted fact that the *Saccomyidæ* and *Geomyidæ* are more nearly related to each other than either of them is to the *Muridæ* or *Castoridæ*, between which they are interposed in Dr. Gill's system; through the practical utility of such "super" groups would be questioned by some naturalists.

Thus determining a family *Saccomyidæ* (characters of which will presently be given), we may, before proceeding further, note what disposition has been made of its component genera. Dr. LeConte, in 1853, and Prof. Baird, both treated only of North American forms, recognizing simply two genera, *Dipodomys* and *Perognathus* (+ subg. *Cricetodipus*). Dr. Gill made no subdivision of the family. Dr. Gray went into this matter by dividing his *Saccomyinæ* (= *Saccomyidæ*) into two groups of no assigned value, namely, *Dipodomyina*, with *Dipodomys* alone, and *Heteromyina*, to include all the other genera. This division is based primarily upon the state of the molars, whether rootless (*Dipodomys*) or rooted. The *Heteromyina* of this author are further divided into those with sulcate superior incisors (*Perognathus*, "Abromys," and *Cricetodipus*) and those in which the upper cutting teeth are smooth (*Heteromys* and *Saccomys*).

I am insufficiently acquainted with *Heteromys* and *Saccomys* to say how nearly they approach, or how far they recede from, the *Perognathi* with which I am familiar; nor have I at present the material to inform myself. Of *Saccomys* I do not find that any one has precise knowledge at present; the very habitat of the animal is uncertain. To the orginal *Heteromys anomalus* (*Mus anomalus*, Thomps., Linn. Trans. XI. 151, pl. 10—*fide Gray*) Dr. Gray added several others in 1868, all from Middle America. As this author draws his characters, with the exception of those of the front teeth, entirely from some trivial superficialities which may be observed upon looking at stuffed skins, I am unable to gain from his remarks any satisfactory opinion respecting the degree of relationship subsisting between *Perognathus* and *Cricetodipus* on the one hand, and *Heteromys* and *Saccomys* on the other. My impression is, however, that characters of more than generic value will be found to distinguish them.

However the case may stand respecting *Heteromys* and *Saccomys*, concerning which precise information is greatly to be desired, it is demonstrable that the genus *Dipodomys* stands quite isolated from *Perognathus* and *Cricetodipus* by its extraordinary cranial peculiarities. This circumstance throws the North American genera into two distinct subfamilies, very easy to characterize.

In these preliminary remarks I wish, furthermore, to insist upon the full generic distinctions between *Perognathus* and *Cricetodipus*. The latter was first satisfactorily characterized as a subgenus by Prof. Baird, upon certain obvious and eligible external characters alone. But examination of the skull, which Prof. Baird, it seems, did not make, has satisfied me that the cranial characters are fully up to the current generic mark. *Cricetodipus*, in fact, makes a decided step away from *Perognathus* in the direction of *Dipodomys*, though still falling far short of the exaggerated peculiarities of the latter.

Family SACCOMYIDÆ (Baird).

=*Saccomyinæ*, Baird, Mamm. N. A. 1857, p. 404. (Subfamily.)
=*Saccomyinæ*, Gray, P. Z. S. 1868, 199. (Family.)
=*Saccomyidæ*, Gill, Arrang. Fam. Mamm. 1872, p. 21, No. 100.

Chars.[1] Skull light, thin, and papery, with few if any decided angles or ridges; rostrum elongate, attenuate, and tapering; nasals projected beyond incisors. Inter-mastoid width not less than the inter-zygomatic, sometimes much greater. Inter-orbital space much wider than the rostrum. Occipital region formed largely or mostly of the mastoids. Palatal surface nearly flat and horizontal. No anteorbital foramen in a usual site, but a large, rounded perforation of the side of the maxillary, instead. Zygomata slender, depressed in position, almost or quite abutting behind against the tympanic; malar thread-like. A delicate scroll-like lachrymal, easily detached. Frontal broadly trapezoidal. Parietal broad, triangular or pentagonal. A large interparietal, embraced

[1] The characters are drawn from *Perognathus*, *Cricetodipus*, and *Dipodomys*; but there is every reason to believe that no essential modification of the phrase is required to embrace *Saccomys* and *Heteromys* as well. Special reference is had to antithesis with *Geomyidæ*.

betwixt forks of the occipital. Squamosal almost entirely restricted to the orbit. Tympanic more or less inflated. Mastoid enormously enlarged and bullous, mounting to the top of the skull, and also forming much or most of the occipital surface, the occipital being correspondingly reduced, and scarcely or not forming part of the general occipital surface. Petrosals moderately inflated, their apices closely approximated or even in mutual contact. Coronoid process of mandible slender, sloping, prickle-like, scarcely or not attaining top of condyle; mandible small and weak in comparison with rest of skull. Incisors variable (the upper compressed and sulcate in North American genera, said to be broad and smooth in *Saccomys* and *Heteromys*). Molars $\frac{4-4}{4-4}$, rooted or rootless. General form murine; body slender and graceful; ears and eyes well developed. Hind limbs somewhat or decidedly saltatorial. Tail as long as the body (more or less). Fore claws moderate, not obviously fossorial. External cheek pouches ample, not connected with the mouth, furry inside, furnished with a special muscle (these pouches as in *Geomyidæ*, but no other rodents). Pelege generally coarse and harsh, said to be sometimes "spiny," always without under fur. The species very active and quick in their movements, like mice.

The foregoing characters amply suffice for the determination of this family, though others might be adduced. The skull is very peculiar; its main features result from the exaggerated state of the mastoids, which produce great width behind, roof much of the cerebral cavity, pinch the occipital, and push the squamosal into the orbit. The next most prominent features are the slight thread-like malar, attenuated rostrum, and flat palate. The curious position of the anteorbital foramen is shared by the *Geomyidæ*. To bring the comparative characters of *Saccomyidæ* and *Geomyidæ* into strong relief, the following may be adduced:—

GEOMYIDÆ. (*Geomys and Thomomys.*)	SACCOMYIDÆ. (*Perognathus*, *Cricetodipus*, *Dipodomys.*)
Skull massive, angular, in general of an arvicoline type.	Skull delicate, with rounded-off angles and slight ridges, if any.
Interorbital constriction narrower than rostrum.	Interorbital space much broader than rostrum.
Interzygomatic width the greatest diameter of the skull.	Intermastoid width the greatest diameter of the skull.

GEOMYIDÆ. (*Geomys and Thomomys.*)	SACCOMYIDÆ. (*Perognathus, Cricetodipus, Dipodomys.*)
Palate strongly sloping downward far below level of zygomata.	Palate nearly horizontal, little if any below the level of zygomata.
Nasals not produced beyond incisors; rostrum broad, blunt, parallel-sided.	Nasals produced beyond incisors; rostrum compressed, tapering, acute.
Zygomata strong, flaring, with stout, short malar, having ordinary connections.	Zygomata slender, parallel, with long thread-like malar, almost or actually abutting against tympanic.
Frontal compressed.	Frontal very broad.
Parietals compressed, irregularly linear, remote from orbits.	Parietals broad, triangular or pentangular, coming to edge of orbits.
Squamosals roofing most of cerebral cavity, from roof of which mastoids are excluded.	Squamosals mostly or wholly restricted to the orbits; mastoids roofing much or most of cerebral cavity.
Tympanics contracted, tubular.	Tympanics more or less inflated, vestibular.
Petrosals widely discrete.	Petrosals approximating or in actual contact at their apices.
Occipital broad, forming most of occipital plane, but not mounting on top of skull.	Occipital contracted, scarcely or not entering occipital plane, but mounting top of skull, to there embrace interparietal between its forks.
Molars rootless.	Molars rooted (except in *Dipodomys*).
Large erect falcate coronoid overtopping condyle.	Small, sloping, prickle-like coronoid below condyle.
Lower jaw large and strong.	Lower jaw small and weak.
General form heavy, squat, clumsy—arvicoline.	General form light, lithe, and graceful—murine.
Fore limbs highly fossorial.	Hind limbs more or less saltatorial.
Eyes and ears minute.	Eyes and ears large.
Tail much shorter than body.	Tail nearly as long as or longer than body.
Pelage usually soft, lustrous, mole-like.	Pelage usually coarse and hispid.
Habits completely subterranean.	Habits exposed.

We may next illustrate the points of resemblance between *Saccomyidæ* and *Geomyidæ* as distinguished from other rodents, thereby showing the characters of the "superfamily" *Saccomyoidea* as named, but not defined, by Gill—the former family *Saccomyidæ* of Baird.

SACCOMYIDÆ and GEOMYIDÆ.—Mastoid bone inordinately developed, occupying much of the occipital or superior surface of the skull, or both. Occipital correspondingly reduced. No postorbital processes; no anteorbital foramen as such, in its stead a perforation in the side of the maxillary far forward and low down. Zygomatic process of maxillary an expanded perforate plate. Molars $\frac{4}{4}$. Root of under incisor more or less protuberant posteriorly. Descending process of mandible an obliquely twisted plate, projecting outward and upward. Large external fur-lined cheek pouches with special muscle; upper lip densely hairy, not visibly cleft; feet pentadactyle; fore claws longer than hinder ones. Pelage without under fur.

It will be observed that the differences outweigh the resemblances, notwithstanding the higher taxonomic value of some of the latter. The peculiar state of the temporal bone, the position of the anteorbital foramen, the shape of the jaw, and the presence of the pouches are the main common characters. In contrasting the two families, the very peculiar genus *Dipodomys* offers the strongest points of difference; but when we come to consider *Perognathus* and *Cricetodipus*, many of the expressions applicable to *Dipodomys* require modification. *Perognathus* is a link between the two families, just as, in its own family, *Cricetodipus* is between *Perognathus* on the one hand, and the extraordinarily modified *Dipodomys* on the other.

This brings us to consideration of what if any division may be made of the family *Saccomyidæ* into groups of more than generic value. The genus *Dipodomys* is so exaggerated in some of its peculiarities that, as it seems to me, its features may properly be set over against the characters which *Perognathus* and *Cricetodipus* share together. The leading antitheses may be indicated in the following manner:—

Subfamily PEROGNATHIDINÆ. (*Perognathus* and *Cricetodipus*.)	Subfamily DIPODOMYINÆ. (*Dipodomys* alone.)
Molars rooted.	Molars rootless.
Anterior molar with a lobe in addition to the main prism.	Anterior molar a simple prism.
Skull half as wide as long, and two-thirds as high as wide.	Skull two-thirds as wide as long, and half as high as wide.
Mastoids moderately developed (for this family).	Mastoids extraordinarily developed (even for this family).

Subfamily PEROGNATHIDINÆ.	Subfamily DIPODOMYINÆ.
(*Perognathus* and *Cricetodipus*.)	(*Dipodomys* alone.)
Tympanic little inflated.	Tympanic completely bullous.
Occipital plane not, or not much, emarginate.	Occipital plane deeply emarginate.
Petrosals, though approximate, not in contact with each other, but with the basi-occipital throughout.	Petrosals in mutual contact at their apices, and fissured away from basi-occipital.
Zygomatic plate of maxillary of ordinary rodent character.	Zygomatic plate of maxillary roofing much of the orbit.
Parietals pentangular.	Parietals triangular.
Interparietal wider than long.	Interparietal longer than wide.
No pit on inner side of jaw near the molars.	A deep pit on inner side of jaw near the molars.
Hind limbs little if any longer than the fore, not very obviously saltatorial.	Hind limbs elongated, jerboa-like, highly saltatorial.
Soles naked or sparsely pilous.	Soles densely hairy, like a rabbit's foot.
Pelage comparatively coarse and harsh.	Pelage comparatively soft.
Inner hind digit moderately developed and low down.	Inner hind digit rudimentary and elevated.

I am unable to say how nearly the genera *Saccomys* and *Heteromys* may coincide with the characters of *Perognathidinæ* as here established; but it is my impression that they will prove to constitute a third subfamily. In such case, some of the characters of the three would be as follows:—

DIPODOMYINÆ. Molars rootless; upper incisors compressed, sulcate.

PEROGNATHIDINÆ. Molars rooted; upper incisors compressed, sulcate.

SACCOMYINÆ. Molars rooted; upper incisors broad, smooth.

Subfamily PEROGNATHIDINÆ, Coues.

The characters of the group having been already sufficiently elucidated, it only remains to note the two genera by which it is represented in North America. These may be readily distinguished by much stronger characters than any hitherto adduced.

Genus *Perognathus*.	Genus *Cricetodipus*.
Occiput nearly plane, *i. e.*, the mastoids not projecting noticeably back of the occipital.	Occiput with a broad emargination, *i. e.*, the mastoids bulging decidedly back of the occipital.
Apices of petrosals separated by the whole width of the basisphenoid.	Apices of petrosals almost meeting beneath the basisphenoid.
Parietals perfectly pentagonal, with nearly equal sides.	Parietals imperfectly pentagonal, inæquilateral.
Interparietal elliptical, much broader than long, embraced between narrow plates of occipital.	Interparietal pentagonal, shield-shaped, embraced between mere spurs of the occipital.
Ear with a distinct upright lobe of the antitragus, and generally also a lobe of the tragus.	Ear with no vestige of a lobe either of antitragus or tragus.
Soles naked to the heels, at least along a central stripe.	Soles entirely hairy on the posterior half.
Size of Mus musculus, or much larger.	Very diminutive; much less in size than Mus musculus.

The cranial characters above adduced, it may be observed, are all co-ordinated with the single main feature of much greater development of the mastoid in *Cricetodipus* than in *Perognathus*, the state of the parts in the former being an evident approach to the peculiarities of *Dipodomys* itself. The difference in the shape of the occiput is very striking when skulls of the two genera are laid beside each other—the part in *Perognathus* being quite flat, as in most rodents, while *Cricetodipus* shows an emargination, much broader and shallower than in *Dipodomys* indeed, but still well marked. These cranial peculiarities, substantiating a genus *Cricetodipus* distinct from *Perognathus*, do not appear to have been noted before. They are correlated with the excellent and readily appreciable external characters of the feet and ears already presented by Prof. Baird.

I. Genus **PEROGNATHUS**, Maxim.

=**Perognathus**, Maxim., Nov. Act. Acad. Cæs.-Leop. Carol. XIX. 1839, 369. Type, *P. fasciatus*.

<**Perognathus**, LeConte, Proc. Acad. Nat. Sci. Phila. 1853, 224; includes *Cricetodipus*.—Baird, Mamm. N. A. 1857, 416; includes *Cricetodipus*.

Having already indicated the generic characters of *Perognathus*, I need only here give some further details respecting the skull and teeth, following with an analysis of the species. I have before me skulls of all the described North American species excepting *fasciatus*. They are so nearly similar, that description of one will suffice for all, barring some slight ultimate details of size, etc. I select that of *P. penicillatus* for description, omitting generalities already presented. The description may be compared with that of *Dipodomys* given beyond.

Although the temporal bone is largely developed in the mastoid element, that lacks the enormous inflation seen in *Dipodomys*, the general shape of the skull being not dissimilar to that of several allied rodents. Nevetheless the mastoid represents the postero-exterior aspect of the skull, and is large enough to crowd the squamosal into the orbit, and cause a slight protuberance beyond the actual plane of the occipital bone. But this is insufficient to produce even the moderate emargination of this surface witnessed in *Cricetodipus*, and is nothing at all like the regular cleft or chink seen in *Dipodomys*. The ends of the petrosals are fairly separated by the width of the basisphenoid; they lie in contact throughout with the basioccipital, and show a conspicuous foramen posteriorly on the inner side. The meatus auditorius appears as a mere flange-like projection, intermediate in character between the swollen vestibule of *Dipodomys* and the contracted tube of *Geomyidæ*, though nearest the latter. The occipital is broader than in any other genus of the family, the forks which embrace the interparietal being fairly laminar, instead of mere spurs. The interparietal is much wider than long. The parietals are almost perfectly pentangular. A slight spur of the squamosal pushes out toward the meatus, but does not extend as a long clasp over the tympanic;[1] the squamosal is otherwise wholly orbital. The frontal is quite flat on top, squarely and straightly truncate behind, serrate in front for articulation with the rostral bones, and with straight sides convergent posteriorly. There is a large lachrymal of wholly irregular shape, extensively scroll-like, very delicate in texture, and loosely attached; it closes a large aper-

[1] In a specimen of *Cricetodipus*, I clearly see that a long slender spur is sent out from the squamosal, like a clasp or hasp, lying above and reaching back of the meatus. *Cf.* what is said of an apparently similar, but not well made out appearance in *Dipodomys*, beyond. It is, in this case, a slender remnant of squamosal bone, left in an ordinary place, after most of the bone has been shoved into the orbit by the encroachment of the mastoid.

ture leading into the nasal chamber. The orbit is also perforate behind by a single very large foramen of exit of cranial nerves. It is bounded in front, but not roofed over, by the zygomatic plate of the maxillary, not noticeable in character. The extremely delicate malar sutures in front for a long distance clasp-like against the zygomatic process; behind it simply abuts against a slight heel of the squamosal, almost in relation with the tympanic. The singularly displaced "anteorbital" foramen is a large rounded aperture in the side of the snout, communicating directly with the nasal cavity. The nasal bones are parallel-edged for most of their length, but widen a little and become semi-tubular anteriorly where they project; they are truncate behind, reaching opposite the middle of the jagged fronto-maxillary suture. The sides of the rostrum are contracted below, leaving a very narrow bridge of bone between molars and incisors; the contracted incisive foramina are bounded behind by the maxillaries, though they are chiefly pierced in the intermaxillaries. The intermolar portion of the palate is longer than wide, and a little convergent anteriorly; the maxillo-palatine suture is opposite the second molar; there is a pair of deep palatal pits opposite the last molars; behind there is a pair of much larger vacuities bounded by palatals in front, sphenoid behind, and pterygoids internally. The latter are simple, straight, nearly parallel processes, bounding the contracted posterior nares, and abutting against the petrosals. The orbital plate of the sphenoid is of moderate extent, owing to the size and site of the squamosal.

The molars in this genus, as in others of the family excepting *Dipodomys*, are all rooted. They have been said to have four roots, but such is not the case in the specimens I have examined. In *P. penicillatus*, all the upper molars have three roots apiece, and all the under molars have two roots apiece, excepting the back upper one, which has but one. The front upper molar has one root in advance, corresponding to the anterior lobe of this tooth, and a pair of roots obliquely side by side behind. The next two upper molars have each an exterior pair of roots, lengthwise, and a larger single root on the interior side; the back upper molar is simply single-rooted. The under molars have each a pair of roots, alligned lengthwise in a single series, but the two roots of the back lower molar are imperfectly distinguished. With these last exceptions, each root of all the teeth has its own distinct socket in the alveolus.

In the perfectly unworn state, the crowns of the molars are studded with tubercles in regular transverse series. In the upper jaw the anterior molar has four, an anterior, a posterior, an exterior, and an interior, with perhaps another one part way up the anterior lobe. The second and third upper molars have each six tubercles, in two straight transverse rows of three each, these rows separated by a deep sulcus. The smaller circular back upper molar tends indistinctly to a similar state. In the lower jaw the tuberculation is very similar; but the four tubercles of the first molar are in an anterior and posterior pair, and on the last one the tubercles become indistinct.

The teeth present a very different aspect when the tubercles are ground off with wear. Each transverse row of tubercles becomes converted into an island of dentine, there being thus, on the intermediate molars at any rate, a pair of such transverse dentine islands separated by a double ridge of enamel partition, between which is the bottom of the sulcus already mentioned. This enamel fold makes in from the outer side of the tooth nearly to the inner side. The front molar shows a little isolated island of dentine anteriorly, nearly circular, and a broad transverse one posteriorly. The state of the under teeth is essentially the same.

The upper incisors are small, compressed, with a strong backward set. Their face is deeply channelled with a longitudinal groove, and the exterior moiety is rabbeted down so that the groove is visible laterally as well as from the front. This is a prominent character, shared by *Cricetodipus* and *Dipodomys*, in distinction from *Saccomys* and *Heteromys*. The under incisors are small and simple.

Before leaving this portion of the subject, I may as well mention a curious circumstance: the ease with which the skulls of *Perognathus* and *Cricetodipus* break apart across the middle. This seems to be chiefly due to the delicate state of the zygomata, which afford no stable connection between the fore and aft parts. The break occurs at the basispheno-occipital, squamo-mastoid, and fronto-parietal sutures—the parietals, temporals excepting squamosals, with the occipital, coming away from the rest of the skull.

Explanation of figs. Left ear, in each case, twice natural size; upper fig. *P. monticola;* middle fig. *P. penicillatus;* lower fig. *Cricetodipus flavus.*

There appears to be something peculiar, in the habits perhaps, rather than in the scarcity, of the species, which prevents the acquisition of large series of specimens in this family. While hundreds of examples of animals no larger or more conspicuous than these are readily amassed, collections are all deficient in *Perognathus* and *Cricetodipus*, and not very full in *Dipodomys.* I have not been able to examine more than a hundred specimens altogether, and of these more than half were *Dipodomys.* Of *Perognathus* I have however specimens of all the described North American species, including all of Baird's types and considerable additional material. After protracted examination, I endorse the validity of all the species admitted by that author in 1857, and find indications of the probable existence of one or two more. This point is fully discussed beyond. The species that appear to be established may be readily determined by the following analysis, viz:—

A. Notch of the ear bounded in front by a slight, though distinct, lobe of the tragus. Whole fore leg white.

a. Tail penicillate, crested at the end, rather longer than the body and head. Sides with no fulvous stripe. PENICILLATUS.

b. Tail simple; sides with a strong fulvous stripe.

1. Tail decidedly shorter than the body and head. Length about 4 inches. Pelage moderately stiff. Mixed sandy and blackish. FASCIATUS.

2. Tail not shorter than head and body. Length about 3 inches. Pelage very hispid. Mixed cinnamon and blackish. . . HISPIDUS.

B. Notch of ear formed in front directly by the edge of the conch. Fore leg mostly colored like the back.

Tail simple; lateral stripe obscure. . . . . MONTICOLA.

Perognathus fasciatus, Maxim.

Perognathus fasciatus, Maxim., N. Act. Akad. Leop-Caes. Nat. Cur. xix. pt. i. 1839, 369, pl. 34; Reise Nord-Am. i. 1839, 449; Arch. f. Naturg. 1861, ; Verz. Reise, 1862, 175, pl. 4, f. 6, 7. Wagn., Arch.

f. Naturg. 1841, 45; Suppl. Schreb. iii. 1843, 612. Schinz, Syn. Mamm. ii. 1845, 259. LeC., Proc. Acad. Nat. Sci. Phila. vi. 1853, 224. Aud. & Bach., Q. N. A. iii. 1854, 341 (compiled). Giebel, Säugeth. 1855, 572 (compiled). Bd., M. N. A. 1857, 421 (Chihuahua). Bd., U. S. Mex. Bound. Surv. ii. pt. ii. 1859, Mamm. p. Suckl., P. R. R. Rep. xii. pt. ii. 1860, 101 (compiled). Gray, P. Z. S., 1868, 201.
Perognatus fasceatus, Lincecum, Am. Nat. vi. 1872, p. 369 (habits).
Prognathus faceatus, Lincecum, Am. Sportsman, Feb. 28, 1874 (habits).

Diagn. Largest of the genus; considerably exceeding *Hesperomys leucopus*, and approaching *Tamias quadrivittatus* in size; length four inches or more; tail less; hind foot about one inch. Tail decidedly shorter than head and body, not penicillate. Ears large; antitragus distinctly lobed. Soles naked to the heels—at least along a median strip. Above, reddish-yellow, closely lined with blackish; below, including fore leg all around, white; these two colors separated by a conspicuous stripe of fawn color or salmon red running the whole length of the body; tail distinctly bicolor.

Hab. United States, west of the Mississippi and east of the Rocky Mountains, and northern portions of Mexico. (Originally described from the mouth of the Yellowstone; re-described from Chihuahua. Specimens examined by me from Nebraska, Kansas, Texas, and Chihuahua.)

I regret that the material before me includes no specimens in the flesh, since I am thereby prevented from giving the size and form of the species with desirable precision; fortunately, however, in this instance the characters of the species are so strongly marked, that lack of elaborate details of form will result in no misunderstanding. The coloration, alone distinctive, can be accurately given from several well-prepared skins before me.

This species, the type of the genus, exhibits very distinctly the two leading features of external anatomy which distinguish *Perognathus* proper from *Cricetodipus;* namely, the lobe of the antitragus and the naked strip of the sole extending quite to the heel. It is much the largest species of the genus known to inhabit the United States, considerably exceeding *P. penicillatus* (which about equals *Hesperomys leucopus* in size), and in fact, some specimens are little if any smaller than *Tamias quadrivittatus*. For the reason above given, the dimensions cannot be stated with precision; but the length from nose to root of tail is obviously more than four inches in all but one of the specimens before me; the tail is decidedly shorter than the head and body (in all the other species treated in this paper it is as long or longer). The vertebræ of the tail of the only specimen before me in which these bones remain in situ, measure less than 4.00 inches, the length of the head and body of the same specimen being about 4.50. Likewise the hind feet are proportionally shorter than in any of the other species; they average only one inch in length, thus not exceeding those of *P. penicillatus*, which is a smaller animal. On the contrary, the ears are larger, both absolutely and relatively, than those of any other species, standing about 0.40 high, measured from the notch; the ears thus project conspicuously above the fur of the parts; the flap is suborbicular in outline; the antitragus develops a very prominent lobe, bounding the notch posteriorly; and in front of the notch there is also a little prominence, just behind the termination of the margin of the ear. The flattened portions of the auricle are sparsely pilous inside and out, and a tuft of lengthened hairs springs from the front border of the ear.

The attenuated and elongated muzzle is densely pilous, excepting a small T-shaped nasal pad, divided by a median depression. The upper lip, in particular, is thickly covered with stiffish, flaring hairs, completely concealing any median cleft which may exist, and forming a heavy fringe which droops over and almost hides the incisors; there is a reversed tuft of bristly hairs on the chin. The openings of the cheek pouches seem to have no peculiar character, being much as in other species of the genus; the cavity admits the first joint of one's little finger. The whiskers are very numerous and fine; the shorter colorless ones seem like mere lengthening of the hairs of the muzzle; others, stiffer and colored, reach rather beyond the head. There are also some long special bristles over the eye, and others between the eye and ear.

The palm proper, and under surfaces of the digits, are perfectly naked, though a considerable fringe of hairs falls down from the wrist. There is a large and conspicuous smooth tubercle on the outer side, at the base of the fifth digit; two others, one on each side, at the wrist, and others at the bases of the intermediate digits; the disposition of these smaller ones is not very evident in the dried specimens. The thumb is rudimentary, a mere stump, bearing a flattened obtuse nail; the other digits are armed with ordinary compressed, acute and moderately curved claws; the 3d is longest; then come 4th, 2d, and 5th in succession. Of the hind foot, the sole is perfectly naked for its whole length along a median strip, narrowed by encroachment on either side of a fringe of hairs. On the outer side, about half-way from heel to base of digits, is a small tubercle; there is another near the base of the 1st digit, and a much larger one near the base of the 5th digit, with others still at the bases of the intermediate digits; but their precise disposition, and the character of the naked sole cannot be made out perfectly. The first digit is very small, with a smooth bulbous end and short blunt claw; the other claws are of a more ordinary character, but relatively shorter, blunter, less compressed and less curved, than those of the hand; they are excavated underneath.

The tail is completely but rather thinly haired; and, especially toward the end, the hairs stand apart and are somewhat lengthened (as is usual in the genus); still they do not develop into the decided comb or crest, or tuft at the end, which is characteristic of *P. penicillatus*.

The pelage of this species is coarse, harsh, and stiffish (as in other species of typical *Perognathus*), though not to a degree which could bear the term "spiny" or even bristly; it has been likened to fine-spun glass, though such expression might be considered strong, unless excessively delicate glass is meant. The fur has considerable gloss; there is no under fur whatever. The character seems to me to be much as in the murine *Sigmodon hispidus*, and in fact the specimens before me have considerable superficial resemblance to the young of that species. A likeness to *Jaculus hudsonius* is perhaps even stronger. The color of the upper parts is a light sandy-yellowish, closely lined throughout with blackish, producing a fine grizzle. The greater part of the length of the individual hairs is the color of barely tarnished cut lead; rather light, and unlike the heavier plumbeous of most rodents. This is succeeded by the sandy ends of the hairs; a part of them are of this last color to the very end, while others have the tips blackish, producing the grizzle above mentioned. The line of demarcation of this color begins on the side of the nose, and runs straight over the shoulder and sides of the body, descending the hind limb to the heel. To this succeeds a strip of rich reddish-yellow or salmon-color, beginning on the cheeks and following the line already indicated to the heels, but also descending a little way on the fore leg. This color is pure, the hairs being so colored to the roots, there being no plumbeous basal portions and no blackened tips. The whole under surface, together with the feet, most of the fore leg and the inner aspect of the hind leg, is white, and on these white areas the hairs are of this color to the roots. The line of demarcation with the fawn color is pretty sharp, but less so in some cases than in others, sometimes the whole belly showing a tawny shade. The tail is bicolor; a brown or dusky stripe runs the whole length of the upper surface; the sides and under surface being white or tinged with rusty; the latter particularly when the white of the belly is similarly tinged. Besides these special markings, there is decided indication of a dusky stripe from the nose under the eye and ear to the side of the neck, produced by increase of the blackened tips of the hairs along the line. Some of the whiskers are black, others being colorless. The pouches are white inside. The claws are colorless.

The series of specimens at my command does not suffice for a complete exposition of the variation in color of this species. In all the lateral stripe is conspicuous, and the other characters differ little. I note, however, a decidedly richer tone in the Mexican and Texan specimens than in those from Kansas and Nebraska.

It is probable that the skull of this animal, when examined, will afford some appreciable specific characters, in size at least, if not in details of conformation.

Perognathus penicillatus, Woodh.

Perognathus penecillatus, Woodh., Proc. Acad. Nat. Sci. Phila. vi. 1853, 200. (San Francisco Mts., Arizona.)

Perognathus penicillatus, Woodh., Sitgreaves' Rep. Expl. Zuñi and Col. R. 1853, 49, pl. 3.—Le C., Proc. Acad. Nat. Sci. Phila. 1853, 225. (Mere mention.)—Aud. and Bach., Q. N. A. iii. 1854, 298. (Copied from Woodh.)—Bd., M. N. A. 1857, 418, pl. 20, f. 5.—Gray, P. Z. S. 1868, 201. (Wrong locality assigned.[1])—Coues, Am. Nat. i. 1867.

Perognathus parvus, Le Conte, Proc. Acad. Nat. Sci. Phila. vi. 1853, 225, in part. Not *Cricetodipus parvus*, Peale. (The specimen noticed, from the Colorado Desert, is apparently a very young example of *P. penicillatus*.)

Diagn. About the size of *Hesperomys leucopus*. Tail vertebræ obviously longer than head and body. Hind foot more than one-fourth the length of head and body. Tail crested above towards

[1] The San Francisco Mountains are several hundred miles from San Francisco City, California, nearly in the middle of Arizona—formerly a part of New Mexico. The locality appears to puzzle some writers.

the end, and with long terminal pencil of hairs. Soles distinctly naked to the heels, at least along a median strip. Antitragus distinctly lobed, with a sharp teat-like projection, opposite which is another smaller but distinct lobe of the tragus, the notch of the ear being defined by these two prominent points, the edge of the ear itself not bounding the notch at all. No appreciable fulvous stripe along the sides, where the color of the upper parts meets the white of the under parts without intervention of a third color. Above, gray; an intimate mixture of yellowish-gray with a dull grayish-brown; below, including whole fore leg, fore and hind feet, and inner aspect of thighs, white; tail bicolor—dark above, white below. Length about 3.25 inches (2.90–3.60); tail vertebræ about 4.00 (3.50–4.40), with a tuft half an inch or more longer. Soles about 0.95 (0.90–1.00); ear above notch, 0.33 (0.30–0.35).

Hab. The basin of the Colorado River. (The very few specimens at present known to naturalists have all come from Arizona and the adjoining border of Southern California.)

Description (from Woodhouse's type (mounted), and several more recent specimens, dry and in the flesh).—In all the other species of *Perognathus* given on these pages the tail, whether longer than the body or decidedly shorter, is simply haired, with the terminal hairs no longer than those surrounding the tail. The present species is therefore remarkably distinguished by the comb or crest of long hairs on the terminal third or more of the member, produced by a gradual lengthening until those at the end are half an inch or more in length, producing a penicillate brush proportionally as long as that of some species of *Tamias* or even *Sciurus*. With this singular character others of equal tangibility are coördinated. The description to be given will include some points common to the genus, as, with one exception, the present is the only species of *Perognathus* of which I have specimens in the flesh.

The head is about one-third of the total length of head and body; broad and full across the temporal and orbital regions, thence tapering rapidly to the produced but rather blunt snout. The muzzle is entirely and densely pilous excepting a small nasal pad, with a median furrow; the nostrils are very small and irregular in contour. The long upper lip is heavily clothed with stiffish hairs, forming a fringe which droops over and hides the incisors. The whiskers are numerous and very fine; besides the labial set, the longest of which much exceed the head in length, there are others about the eye and ear. The eye is of moderate size, and situated much nearer to the ear than to the nose. The ear shows very conspicuously the prominent lobe of the antitragus which is the chief external peculiarity of this genus as compared with *Cricetodipus;* and opposite to it, on the other side of the notch, there is a similar and smaller but still very evident tubercle, just within the border of the ear. These two prominences together cause the notch of the ear to be very strongly defined, and the margin of the external ear is altogether excluded from the notch. The contour of the ear is broadly rounded. The slit of the cheek pouch is about half an inch long, beginning on the side of the upper lip and curving around with a free border to near the angle of the jaw, there being but narrowly separated from its fellow.

The details of the palms and soles, as clearly made out from the material before me, are probably applicable also to those other species of the genus of which only dried skins are before me. The palm is entirely naked; it presents posteriorly a pair (inner and outer) of immense smooth tubercles, reminding one of the state of the parts in *Geomys.* Anteriorly there are three smaller but still very conspicuous bulbs; one at the base of, respectively, the 2d and 5th digits, and one at the conjoined base of the 3d and 4th. The palm is otherwise uniformly studded with small elevated granulations, and the digits are similarly roughened underneath. The minute thumb ends club-shaped, bearing upon its back a flat nail, which, like those of the human fingers, does not project at all beyond the end of the digit. The whole thumb is no more conspicuous than one of the palmar pads. The other digits bear ordinary claws; the 3d is longest; the 2d and 4th are subequal to each other and but little shorter than the 3d; the 5th is more abbreviated, but its claw-tip still falls beyond the base of the 4th claw.

As a consequence perhaps of the desert habitat of this species, the nakedness of the sole, which is one of the secondary characters distinguishing the species of *Perognathus* from those of *Cricetodipus,* is here carried to an extreme. The sole may be called naked without qualification; for the fringe of hairs which droops over its sides does not encroach in the least upon the under surface except just at the side of the contracted posterior part of the heel itself. The whole sole is uniformly paved with minute granulations. Among these, one constantly larger than the rest is always observed on the inner side about half way down the metatarsus; and a similar one is found at the base of each of the digits. The digits are marked beneath with transverse lines of impression, and end in a smooth slightly clubbed tip. The first digit, though small, is perfectly formed, and bears an ordinary claw, the tip of which falls opposite the base of the second digit; the longer 3d digit but slightly exceeds the 2d and 4th, which are about equal to each other; the end of the claw of the 5th digit falls opposite the middle of the 4th one.

In the development of the hind limbs of this and the next closely allied species of *Perognathus*, there is more indication of a saltatorial tendency than appears in the case of *P. fasciatus*, but the difference is not very striking; it is no more than that which may be inferred on comparison of *Cricetodipus parvus* with *C. flavus*, and it falls far short of the state of the case exhibited by *Dipodomys*. Still, the supposed saltatorial character is further borne out, upon analogy, by the peculiar character of the long penicillate tail, already fully described.

I find it difficult to describe the color of the upper parts satisfactorily. It has been called "a light dull yellowish-brown or tawney, lined with dark-brown." The prevailing tone is decidedly "gray" in comparison with the strong mixed yellowish and blackish of *P. fasciatus*—somewhat the shade of dilute coffee and milk. The lighter hairs are dull yellowish-gray, with darker lining of hair brown. There is a general tinge of the palest possible cinnamon. All the bases of the hairs are of the color of fresh-cut lead. There is no appreciable lateral stripe of different color from the upper parts, although just along the line of junction with the white, the color lightens a little for lack of the darker brown lining. The extreme tip of the snout, the cheeks, the whole fore leg, the inner aspect of the hind leg, the feet, under side of tail, and under parts generally, are white; the line of demarcation runs straight from nose to hind leg, where it drops down to the heel. The upper surface of the tail and the brush at the end are hair-brown. Some of the whiskers are black; others, like the claws, are colorless.

The external sexual characters of this and other species of the family are readily recognizable. In consequence of the development of the os penis, the præputial sheath is a resisting prominence immediately in advance of the anus; the same part in the female, shows a conical flap depending from the front of the vulva.

Having only about a dozen adult specimens of this species to examine, the full range of variation can only be given with approximate accuracy. Still the series is a very good one as far as it goes, and the number of alcoholics afford reliable measurements. Dr. Woodhouse's type is much faded by twenty years' exposure to the light. The others agree perfectly in coloration, and the differences in size are slight. I may here remark, that in the table of measurements given by Prof. Baird, the dimension (nose to tail) given from the dried specimens there enumerated is certainly over the mark. Thus, Woodhouse's type is given as 4.12 long, whereas the original description of the same specimen gives this dimension as 3.50.

Measurements.

Current Number.	Locality.	Sex.	From tip of Nose to				Tail to end of		L'th of		Height of ear.	Nature of Specimen.
			Eye.	Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore ft.	Hind ft.		
2676[1]	San Francisco Mts. Arizona...	....	....	0.90	....	3.50	3.70	....	0.40	1.00	0.30	Mounted.
1332	Colorado R. Cal...	....	....	....	....	....	3.00	3.60	....	0.90	....	Dry.
1333	Fort Yuma, Cal...	....	....	....	....	....	3.65	4.15	0.40	0.95	0.30	Dry.
1349	Colorado Desert, Cal.	....	0.50	0.90	1.00	2.50	3.15	....	....	....	....	Alcohol.
8910	Camp Grant, Ariz.	♀	0.60	0.95	1.10	2.90	3.50	4.00	0.35	0.85	0.30	"
4924*a*	Mojave Village "	♂	0.65	1.00	1.25	3.30	....	....	0.45	1.00	0.33	"
4924*b*	" " "	♀	0.55	0.90	1.10	3.00	3.50	4.00	0.40	0.95	0.35	"
4924*c*	" " "	♂	0.55	0.90	1.10	3.00	4.00	4.60	0.40	0.90	0.30	"
4924*d*	" " "	♂	0.60	0.95	1.20	2.90	4.25	4.80	0.40	0.95	0.35	"
4924*e*	" " "	♂	0.65	0.95	1.20	3.50	4.30	4.90	0.40	1.00	0.35	"
4924*f*	" " "	♂	0.60	0.90	1.20	3.60	4.40	5.00	0.40	1.00	0.35	"

Taking the last seven sets of measurements of the foregoing table (all made from sexed specimens in the flesh, and taken by the same person,[2] so that a source of error which lies in different

[1] The measurements of length and of tail vertebræ are from Woodhouse. In its present state the tail, as well as can be judged, is about 4.50 long, exclusive of the terminal pencil, which is half an inch more. The dry measurements are not reliable.

[2] In measuring tails, I take as nearly as possible the true length, by placing one leg of the compasses snugly above the anus. The length to which the tail projects beyond the body-hairs, or its ostensible dimension, is considerably less.

methods of measurement is avoided) we observe that the total length varies from 2.90 to 3.60—a difference of 0.70—a fair rate of variability for a species. The tail, as usual, varies more than the body, or, in this instance, about an inch, whether the vertebræ alone being considered, or the terminal pencil be taken into account. The relatively shortest tail (vertebræ alone), is half an inch longer than the head and body, or, with the hairs, an inch longer. The relatively longest tail (vertebræ alone), is an inch and a quarter longer than the head and body; with the hairs, nearly two inches longer. Much as usual, the rate of relative variability is greater than that of absolute difference in dimension. The soles vary a tenth of an inch in length, or about $9\frac{1}{2}$ per cent. of their average length. Other smaller measurements give corresponding results. The rates of variation, which are determined for the present species, are doubtless equally applicable to others of the genus, of which I have no alcoholic specimens.

Upon the supposition that the other allied species described in this paper are really distinct from *P. penicillatus*, this has a remarkably restricted geographical distribution. So far as I am aware, there are no specimens extant from beyond the limits of the Colorado Valley, in that portion of its extent which embraces Arizona and the contiguous part of California on the opposite side of the river. Specimens are rare; there may be none whatever in Europe. Woodhouse, LeConte, Baird, and myself, are, perhaps, the only naturalists who speak of the species from autoptical examination.

The relationships of some allied species being considered under other heads, the only point now arising for discussion relates to the "*Cricetodipus parvus*" of LeConte, l. c. The specimen upon which the writer based his remarks is now before me. It is not adult, as supposed, but very young and ungrown, as shown by the unworn state of the teeth; although the tail is not crested, there are indications that it would have become so; the relative proportions and coloration are exactly as in *P. penicillatus*, to which I have little hesitation in referring it. In any event it is a true *Perognathus*, and not *Cricetodipus* at all, as shown beyond question by the obviously naked soles and distinctly recognizable lobe of the antitragus.

Perognathus monticola, Baird.

Perognathus monticola, Baird, M. N. A. 1857, 422, pl. 51, figs. *3a–h* (St. Mary's, R. Mts.). Suckl., P. R. R. Rep. xii. pt. ii. 1860, p. 101 (notice of the same specimen).

Diagn. (No. 7251, ♀, Fort Crook, Cala., J. Feilner.) Size of *Mus musculus.* Tail, including hairs, an inch longer than the head and body, the vertebræ alone over half an inch longer. Hind foot nearly one-third as long as head and body; naked strip on sole very narrow posteriorly; antitragus with a great, flat, rounded, upright lobe, but no lobe of tragus opposite, the notch being defined in front by the outer edge of the ear itself. Tail not penicillate nor crested; rather thinly but nearly uniformly haired throughout. Pelage very soft and smooth for this genus—much as in *Cricetodipus.* Color of upper parts descending on the fore leg to the wrist. A fulvous lateral stripe, indistinct but evident; hairs of under parts pure white to the roots; tail bicolor. Above yellowish-cinnamon lined with blackish, the latter predominating; below, white. Length 2.50; tail vertebræ 3.20; hind foot 0.80.

Hab. St. Mary's Mission, W. of Rocky Mts. to Otter Creek, Utah, and Fort Crook, California.

Description.—The generalities of form of this animal are much the same as those of its nearest allies. In relative length the tail nearly equals that of *P. penicillatus*, but it is uniformly haired throughout, without indication of crest or penicillation. The soles are not so extensively denuded as those of *P. penicillatus*, owing to encroachment of hairs from the sides; still there is a fairly naked strip to the extreme heel. The tuberculation of the palms and soles, and the proportions of all the digits, are substantially as in that species. The animal is much smaller than any other species of the genus, not much exceeding a *Cricetodipus* in size. But the most remarkable character is found in the structure of the ear—it is singular how sharply distinguished some species of the genus are in this respect. In *P. penicillatus* a sharp teat-like projection of the antitragus defines the notch posteriorly, and opposite to it on the other side of the notch, there is a similar but smaller prominence of the tragus bounding the notch anteriorly; thus the external edge of the ear itself is altogether excluded from formation of the notch. Now in *P. monticola*, the lobe of the antitragus is a broad, flat, upright flap, both relatively and absolutely larger than that of *P. penicillatus*, but there is no corresponding lobe of the tragus on the other side of the notch, the front border of the notch being formed by the external edge of the ear itself; this state of the parts is an approach to the condition seen in *Cricetodipus*, and is a perfectly distinctive mark of *P. monticola* in its own genus. This important distinction escaped the describer of the species; but it should be added that it is only fully appreciable upon examination of fresh or alcoholic specimens, and that the type of the original description had been mounted when examined. Furthermore, the ears of *P. monticola* are smaller than those of *P. penicillatus*, and scarcely more than half the size of those of *P. fasciatus*.

Another good character of the species is found in the softness and fineness of the fur. The pelage not so stiff and firm as in *P. penicillatus* even, and has nothing of the "spun glass" character seen in *P. fasciatus* and still more so in *P. hispidus*.

The coloration of the species is mainly distinctive in the circumstance that the dark color of the upper parts descends the fore leg to the wrist, whereas on all the other species examined the whole fore leg is white. The upper parts are an intimate mixture of tawny and blackish, much as in *P. fasciatus*. There is an evident but not very distinct lateral fulvous stripe. The under parts, in the specimen described (No. 7251), are light yellow, but this is undoubtedly the effect of alcoholic discoloration, the parts being no doubt white in life. The tail is bicolor to correspond with the body colors.

While there is no question whatever of the distinctness of the subject of the present article from any others described in this paper, there are some points to be considered respecting its reference to *P. monticola* of Baird. The type of this species now before me has been mounted and exposed to the light for about twenty years; it is faded and otherwise in poor state, the end of the tail and much of the fur being lost. The color is now a uniform dull grayish-brown, much like the natural color of *P. penicillatus*, instead of "mixed cinnamon and dusky," as originally described; and the tail is uniformly dingy white, instead of being "colored to correspond;" the hairs below are all white instead of "plumbeous at base;" and no lateral stripe is now appreciable, though an "indistinct" one was mentioned. But the main peculiarity of the species as to coloration, namely, the descent of the dark color down the fore leg to the wrist is still evident, and in short, I find no color differences not explicable upon consideration of the comparative state of the two specimens. We may therefore turn to the matter of size and proportions. Prof. Baird says, "tail rather shorter than head and body," giving the length of the former as 2.67+, and of the latter as 3.00; whereas my animal is but 2.50 long, and has a tail of 3.20. But the decided discrepancies in these statements and measurements are readily reconciled upon the simple consideration that the tail is defective and the body over-stuffed in the type of *monticola*. This brings about an agreement further borne out by the other measurements. In the following table, the first line of measurements are copied from Baird; the other is taken from the Fort Crook specimen, upon which this article is based, before skinning out of alcohol.

Measurements.

Current Number	Locality.	Sex.	From tip of Nose to				Tail to end of		L'th of		Height of ear.	Nature of Specimen.
			Eye.	Ear.	Occip	Tail.	Verteb.	Hairs.	Fore ft.	Hind ft.		
451	St. Mary's, R. Mts.	....	0.46	0.92	1.08	3 00	2 67+	....	..	0.80	0.25	Mounted
7251	Fort Crook, Cala.	♀	0.55	0.85	1.00	2.50	3.20	3.50	0.30	0.80	0.30	Alcohol.

The principal discrepancy being explicable as above, there is nothing whatever in the foregoing table incompatible with specific identity. Moreover, it so happens that the left ear of the type is in sufficiently good preservation to enable me to clearly recognize the peculiar conformation which distinguishes the present species from the others.

To this same species I am also inclined to refer two specimens collected by Mr. H. W. Henshaw on Otter Creek, in Utah. These are apparently young animals, but, as they are not accompanied with the skulls, the fact cannot be determined. The tail of each has been skinned, and is now so shrivelled that nothing can be predicated as to its length, either relative or absolute. The specimens are quite small; they have been over-stuffed, measuring now about 2½ inches, but were probably not much if any over 2, with a hind foot of 0.80; in fact they might be taken at first sight for a *Cricetodipus*. But the soles are naked along a narrow strip quite to the heel; the antitragus has a very prominent lobe; and even from the dried skins I determine, with no appreciable chance of mistake, that the ear has the other peculiarity of *P. monticola*. The pelage is remarkably soft; the coloration is different from that of any other *Perognathus* I have seen, being plumbeous (like the plumbago-colored specimens of *Geomys* and *Thomomys*), with little admixture of lighter color; and the soles show a decided fulvous stripe. But these specimens exhibit the fore leg colored quite to the wrist, and I am inclined to attribute the dark color to their immaturity. I shall therefore assign them to *P. monticola*.

The four specimens noticed are the only ones which have come under my observation. To sum the case in a few words, we have here an animal unquestionably distinct from any of the other species described in this paper, the only question being whether all the specimens referred to it are specifically identical. They ostensibly differ to a degree that would undoubtedly have caused them to be described as two or three species at the period when Prof. Baird's work was prepared. This question must await the reception of additional material for its satisfactory solution. I can only say that I am at present unable to see more than one species. Should the contrary be determined, the present article is to be held as based upon the Fort Crook specimen, to which the name of *P. mollipilosus* may be applied.

Perognathus hispidus, Baird.

Perognathus hispidus, Baird, M. N. A. 1857, 421, pl. 51, fig. 4 *a–g*. Baird, U. S. and Mex. B. Surv. ii. pt. ii. 1859, Mamm. p. —.—Gray, P. Z. S. 1868, 202 (compiled).

Diagn. Ear small, not projecting beyond the fur; its structure as in *P. fasciatus* and *penicillatus* (tragus and antitragus both lobed). Soles naked. Tail not penicillate, rather longer than head and body. Fur exceedingly stiff and coarse. Above yellowish-cinnamon, closely lined with blackish, the color not descending on the fore leg at all. Sides with a conspicuous fulvous stripe. Tail bicolor. Under parts, with hind feet and whole of fore leg, white. Length between 3.00 and 3.50; tail, rather more. Sole of hind foot 0.90.

Hab. The only two specimens known of this species were procured by Lt. Couch at Charco Escondido and Matamoras, Tamaulipas.

Since the introduction of this species, as above, no additional specimens have come to hand; and as we have no further material for amplification or verification of the original description, there is little more to be said about it at present. The animal appears to be perfectly distinct from any other described in this paper. With much the same size and proportion as those of *P. monticola*, it is immediately distinguished by the radical difference in the conformation of the ear, the stouter as well as rather longer feet, and the whiteness of the whole fore leg. From *penicillatus* it differs in the much shorter and not penicillate tail, less extensively denuded soles, and presence of a strong lateral fulvous stripe. It is decidedly smaller than *P. fasciatus*, with which it shares the fulvous stripe, with a tail longer instead of shorter than the body. Ears scarcely half as large, etc. From all these species finally, it differs in the extraordinarily harsh, stiff, coarse hair; this is of great length, and devoid of under fur, as in other species, but represents, in an exaggerated degree, the pelage which is characteristic of the genus, in distinction both from *Dipodomys* and *Cricetodipus*.

The coloration of the species cannot be given with sufficient accuracy. Both the specimens have been skinned out of alcohol, and the tints are probably somewhat modified. One of them has been so discolored by long immersion in a dirty fluid, as to be of a uniform dingy greenish-brown in which the original colors cannot be in the least discovered. The other, in better state, shows the characters pretty well. There is a strong fulvous or salmon-colored stripe along the whole body, just as in *P. fasciatus*. The light color of the upper parts is rather a pale cinnamon than the sandy yellowish of *P. fasciatus*. The hairs are light plumbeous at base, and many of them are tipped with black, giving the dark surface lining. The tail is sharply bicolor to correspond with the body. The under parts, including the whole fore leg and the foot and inside of the hind leg, are white.

As in the case of *P. monticola*, further information respecting this species is much to be desired, particularly as there appear to be some Mexican animals of this genus, with which we are at present not well acquainted. The following measurements are those given by Baird in his original notice:—

Measurements.

Current Number.	Locality.	Sex.	From tip of Nose to Eye.	Ear.	Occip.	Tail.	Tail to end of Verteb.	Hairs.	L'th of Fore ft.	Hind ft.	Height of ear.	Nature of Specimen.
577	Charco Escondido.	♀	0.64	0.93	1.33	3.12	....	....	0.42	0.84	0.37	Alco.
576	Matamoras.......	♂	0.67	1.00	1.33	3.50	3.60	3.80	0.45	0.92	0.37	Alco.

Note on "Abromys lordi," etc.

The foregoing pages embrace an account of all the species of *Perognathus* which have come under my notice. There are, however, several other described animals which appear to belong in this genus or in its immediate vicinity, one of these from the United States. This latter is the *Abromys lordi*, Gray, P. Z. S. 1868, p. 202; the following is the notice in full.

"3. **ABROMYS**, Gray.

"Upper cutting teeth with a longitudinal groove; fur soft, abundant, uniform, long, and close. Tail tapering, cylindrical, covered with short hair almost hiding the rings of scales.

"*Perognathus*, sp., S. Baird, Mamm. N. A. 423.

"ABROMYS LORDI. B. M.

"Fur soft, abundant, gray-washed, with blackish tips; chin and under side of body whitish; tail tapering, gray, with a blackish-brown upper surface and tip; hair of the back dark lead-color, with a short gray band and minute black tip.

"Perognathus monticolor [sic], Lord, in B. M.

"?Perognathus monticola, S. Baird, Mamm. N. A. 422, t. 51, f. 3 (skull).

"*Hab.* British Columbia (*Lord*).

"The teeth destroyed. Length of body and head 3 inches, of tail 3 inches. It differs from Dipodomys phillipsii and other species of that genus in having no white spot over the eye at the base of the ear, or white band across the thigh."

This account, dealing chiefly in vague generalities, and including a trivial comparison with an animal of a widely different genus, is worthless for all practical purposes. It would be well if the type could be re-described with reference to the points which afford distinctive characters in this group. We may suppose the animal to be a *Perognathus*, from the general tenor of Dr. Gray's remarks, and his curiously mixed up quotations; and it is perhaps *P. monticola*, as that species has conspicuously soft hair in comparison with some of its allies, and is of about the dimensions assigned.

Specimens of any Saccomyine form from Oregon and Washington Territory are at present special desiderata.

On the same page quoted, Dr. Gray describes a new species of *Perognathus* in the following terms:—

"PEROGNATHUS BICOLOR, B. M.

"*Perognathus monticola*, Gerrard, Cat. Bones B. M. (not Baird). Black; upper lip, lower edge of the cheek-pouch, head, and under side of body and inner side of limbs white. Fur uniform bristly; bristles elongate, slender, with a slender point, and intermixed with very slender elongated hairs. Tail as long as the body, with rings, square scales, and short bristly hairs.

"*Hab.* Honduras (*Sallé*).

"There is a Spiny Rat from Honduras[1] with a longer tail and smooth front teeth, agreeing in color with the above."

I have never seen a black and white *Perognathus*, nor one in which "bristles" were mixed with "slender elongated hairs;" but seeing the state of the fur in *P. hispidus* should not be surprised at any degree of rigidity the hairs of a species might develop further south.

A "*Perognathus fasciatus* Sallé" (nec auct.) is noticed by Gray (tom. cit.), p. 205, as a synonym of his *Heteromys irroratus*, n. sp. from Oaxaca. This is said to agree with the description of "H. [*i. e.* P.] fasciatus," but to have smooth upper incisors, etc. Gray calls the fur of *Heteromys* "flat channelled *spines*." There is nothing of this character in *Perognathus*, where the most rigid fur of any United States species would scarcely warrant the term "bristly." It is unexpected to find species of *Perognathus*, of two authors, quoted among the synomyms of *Heteromys*.

[1] Characterized on p. 204 as *Heteromys melanoleucus*, with "Perognathus monticolor, [sic] Gerrard, B. M. not S. Baird," quoted as a synonym.

II. Genus CRICETODIPUS (Baird).

?*Cricetodipus*, Peale, U. S. Expl. Exped. 1848, 52. Type ——————?
= *Cricetodipus*, Baird, M. N. A. 1858, 418. Type *Perognathus flavus.* —Gray, P. Z. S. 1868, 202.

In treating of this form as a subgenus of *Perognathus*, Prof. Baird clearly showed its external peculiarities, namely, absence of lobation of the antitragus, hairy soles, and diminutive size; to these points are to be added the cranial peculiarities coincident with decidedly greater development of the mastoid than that seen in Perognathus. The points having already been given, it is needless to recapitulate them.

As noticed further on, the *Cricetodipus parvus* of Peale is an uncertain animal. In erecting *Cricetodipus* into a genus, I take *P. flavus* of Baird as the type, and follow this author in distinguishing a second species, which latter is probably, but not certainly, the *P. parvus* of Peale. The two appear to constantly differ in the following characters:—

Tail scarcely or not longer than the head and body; hind foot scarcely or not one-third as long as head and body. FLAVUS.

Tail decidedly longer than head and body; hind foot more than one-third as long as head and body. PARVUS (of Baird).

Cricetodipus flavus, Baird.

Perognathus flavus, Baird, Proc. Acad. Nat. Sci. Phila. 1855, 332. Baird, M. N. A. 1857, 423, pl. 8, f. 2, pl. 21, f. 3 *a–f* (assigned to Cricetodipus). Baird, P. R. R. Rep. x. 1859, Gunnison's and Beckwith's Route, Mamm. p. 8. Baird, U. S. Mex. B. Surv. ii. pt. ii. 1859, Mamm. p. Suckl., P. R. R. Rep. xii. pt. ii. 1860, 101 (Montana). Hayd., Trans. Am. Phil. Soc. xii. 1862, 147 (Loup Fork of Platte). Allen, Proc. Bost. Soc. N. H. xxii. 1874, 42 (Yellowstone R.).
Cricetodipus flavus, Gray, P. Z. S. 1868, 203 (compiled).

Diagn. Much smaller than Mus musculus; head and body two inches; tail the same; hind foot 0.65; ear small, not overtopping the fur, simple, without lobe of antitragus or tragus. Soles entirely hairy on the posterior half. Tail not decidedly longer than the head and body. Hind foot scarcely or not one-third as long as head and body. Above, pale buff, intimately blended with blackish; below, including whole fore leg, snowy white; sides with a clear buff stripe; tail obscurely bicolor; white touches often found about the ears.

Hab. Rocky Mountains of the United States and eastward in the Middle Faunal Province, from the British Possessions (lat. 49°, *Coues*) to Chihuahua, Mexico. (In the Pacific region replaced by *C. parvus*.)

Description (from numerous alcoholic and dry specimens, including Baird's types). In general points of exterior conformation this animal is so similar to species of *Perognathus* already fully treated, that the account of these features may be abridged. The generic character of structure of the ear and hairiness of the sole, with the diminutive size, are the chief points. The ear is very small and simple, not overtopping the fur of the parts. It is evenly rounded; there is no lobation whatever of either antitragus or tragus, the slight notch which exists being formed in front by the folded-over edge of the ear itself, and behind by the antitragal ridge. The head is full, especially in the frontal region, tapering to a bluntly conical snout, which is densely hairy excepting a minute nasal pad; the upper lip is heavily pilous with a fringe of hairs which droop over and hide the incisors. The eye is rather small, and nearer to the ear than to the nose. The whiskers are very numerous and fine, the longest exceeding the head. On the palms are observed posteriorly two great tubercles, of which the inner is much the largest; there are others at the base of the 2d and 5th, and of the conjoined 3d and 4th digits respectively; otherwise the palm is studded with minute granulations. The thumb is rudimentary, bearing a small flat nail; the other claws are of ordinary character; 3d longest; 4th little less; 2d shorter; 5th still shorter. The hairiness of the soles posteriorly is a generic character in comparison with *Perognathus;* anteriorly granular, with a small tubercle at the base of each digit, and another on the outer side of the metatarsus a little way up. The small size of the hind feet, however, is one of the most obvious distinctions from *C. Parvus.* The longest hind foot measured in upward of twenty cases is only 0.70 long, or barely one-third of the length of head and body, while the average is much below this, and the minimum is only about one-fourth of the length of the head and body. We may say simply that the foot is usually nearer one-fourth than one-third of this dimension. Similarly the shortness of the tail is a second character. In a large series, the vertebræ of the tail average just exactly as long as the head and body; in no case does the tail exceed the body and head by more than 0.25 of an inch, and this length is only exceptionally reached.

In most cases, any difference which may be observed is the other way, the tail being if anything a little shorter than the head and body. The tail, as in other species of this genus and of *Perognathus* (except *P. penicillatus*) is closely, but not very thickly, haired uniformly throughout; the terminal pencil is about a tenth of an inch long.

The pelage is extremely fine, soft, and glossy. The pictura is the same as in other species of this genus and *Perognathus*, namely, colored above with blended light and dark tints, white below, with a clear, single-color stripe along the sides. The upper parts are an intimate mixture of pale yellowish-buff with dark brown or blackish; the hairs are clear lead-color basally, then buff-ringed, then most of them dark-tipped. The resulting tone is nearly uniform over all the upper parts; but there are liable to appear whitish or tawny touches about the ears and eyes, and an appearance of a dark streak along the side of the head. The fawn-colored lateral stripe is uninterrupted from nose to heels; the tint is rather brighter than the buff of the upper parts, and pure, being not mixed with any dusky, and the color extending to the roots of the hairs. The entire under parts, including the whole fore leg, the hind feet, and inner side of hind leg are snowy white, the hairs having no basal color. The tail is obscurely bicolor; white below, and not very sharply colored above to correspond with the areas of the body.

Very young specimens, though nearly full grown and showing a sharp lateral streak, are more simply colored above than the adults, being grayish with extremely faint buffy lining, instead of sharply blackish and buff. There is also observable, in the series before me, a tendency to exhibit two different tones of coloration. Those from dry regions east of the mountains are mixed grayish-brown and grayish-buff, with the lateral pale buff stripe not very conspicuous. In New Mexico, southern Texas, and southward the animal frequently assumes a ruddier shade of the light color, mixed with much less blackish; in these, the lateral stripe is quite indistinct, because the upper parts in general are not very different. But the distinctions in these cases are not strong enough to require anything further than this notice of the fact.

The following table of measurements will illustrate the size and shape of the species very fairly, and to some extent expose the range of variation.

Measurements.

Current Number.	Locality.	Sex.	From tip of Nose to				Tail to end of		Length of		Nature of Specimen.
			Eye.	Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore ft.	Hind ft.	
2615	Milk R., Mont........	..	0.40	0.75	0.95	2 25	2 15	....	0.30	0 70	Alc.
11666	Montana	..	....	....	....	....	....	....	....	0 70	Dry.
4331	Yellowstone..........	..	....	....	....	....	....	....	....	0.70	Dry.
3097	Black Hills..........	..	....	....	....	2 00	2.20	....	....	0 60	Dry.
2614	Ree Fork, "Neb "...	..	0.45	0 80	0.95	2 40	2.20	....	0 30	0 65	Alc.
1931	Rupublican R. "Neb."	..	0.40	0.70	0.85	1.85	1.90	....	0.52	0.60	Alc.
3254	Loup Fork	..	....	....	....	....	....	....	....	0 63	Dry.
7340	" "	♀	....	....	....	2 20	2.30	....	....	0 65	Alc.
3050	Pole Creek..........	..	....	....	....	....	....	....	....	0.68	Dry.
4872	Fort Laramie........	♀	....	....	....	2 25	2.30	....	....	0.65	Alc.
7342	Ft. Bliss, N. M.......	♂	....	....	....	2.10	2.00	....	....	0 55	Alc.
270	Cimarron, N. M......	..	0.45	....	0.85	2.15	2 00	....	....	0 60	Dry.
......	Arizona	♀	....	....	....	1 80	2 00	....	....	0 60	Alc.
......	"	♂	....	....	....	1 90	1 90	....	....	0.60	Alc.
1041	El Paso, Tex.........	..	0 40	0.70	0.85	2 00	1.80	....	0 35	0 65	Alc.
1043	San Antonio, Tex	..	0.45	0.75	0 95	2.20	2.20	....	0 30	0.60	Alc.
2623	Chibuahua	..	0.40	0 70	0 85	1 85	1.60	....	0.25	0.55	Alc.
2613	Matamoras	..	0.45	0 80	0.95	2.15	2 40	....	0.35	0.65	Alc.
	Average	..	0.42	0.74	0.90	2.07	2 06	....	0.30	0.63	

Cricetodipus parvus, Baird (and Peal ?).

? *Cricetodipus parvus*, Peale, U. S. Expl. Exped. 1848, 53, "pl. 13, f. 2." Giebel, Säug. 1855, 600 (compiled from Peale). Gray, P. Z. S. 1868, 203 (compilation of doubtful references).

? *Perognathus* (*Cricetodipus*) *parvus*, Aud. and Bach., Q. N. A. III. 1854, 328 (copied from Peale).

Perognathus parvus, Baird, M. N. A. 1857, 425 (based on a specimen from King's R., Cal., doubtfully referred to C. parvus of Peale). Baird, P. R. R. Rep. X. 1859, Williamson's Route, p. 82 (same specimen).

Diagn. Quite like *C. flavus;* tail and feet longer. Hind foot 0.70 or more, one-third or more as long as head and body. Tail decidedly longer than head and body—the vertebræ about 2.50 inches, to a body of 2.00.

Hab. United States west of the Rocky Mountains. California, Utah (and ?Oregon, *Peale*).

Of this supposed specie I have but a single specimen additional to the material in Prof. Baird's hands in 1857. This is alcoholic, in good preservation, and enables me to give the dimensions with accuracy.

No. 9856, Mus. S. I. ♀. Fort Tejon, Cala. *J. Xantus.* Nose to eye 0.45, to ear 0.70, to occiput 0.90, to tail 2.00; tail vertebræ 2.50, with hairs 2.75; fore foot 0.25; hind foot 0.70; ear above notch, 0.25.

A specimen from Utah (No. 439, Mus. S. I., formerly included by Baird under *C. flavus*) seems to rather belong to *C. parvus*: the hind feet are still longer—nearer 0.80 than 0.70—and the tail at least as long as in No. 9856.

As well as can be judged from the insufficient material before me, this species does not differ materially in color from *P. flavus*: and in fact the only diagnostic characters at present appreciable are the greater length of the hind feet and tail. There is, however, a decided difference in these respects. Further material will be required to confirm the specific distinctness here accorded, or to show that the two supposed species intergrade. Leaving this matter, we may turn to the history of the species, some points of which call for remarks.

In the first place, it is not certain that the animal called *parvus* by Baird in 1857, and by myself in the present instance, is really the *C. parvus* of Peale. Prof. Baird spoke somewhat guardedly in the matter, although he did not formally query his citations, as I have done, and I find myself equally in doubt. Nor do I see how the point is to be determined. For Peale's type, having been lost or mislaid, is not at hand to testify; and Peale's description, though elaborately detailed, will be found to consist entirely of supergeneric characters, shared by all the species of *Perognathus* and *Cricetodipus*, excepting the phrase "color above sepia-brown," which is applicable to none of the species known to me. The dimensions assigned agree exactly with those of the animal defined in this article; but they are equally applicable to a very young *Perognathus*. In fine, there is no *proof* that Peale's genus and species was not based upon a young *Perognathus*—possibly *monticola*. Therefore, while glad to concede that the probabilities are the other way, I think it safest to query the citation of Peale's animal and the compiled references that go with it; and I rest upon the *Perognathus parvus* of Baird, about which there is no uncertainty. LeConte's *P. parvus*, as I have already shown, is really based upon a very young example of *P. penicillatus*.

Baird's animal, from King's River, Cal., upon which the present account is entirely based, is very immature, as shown by the state of the teeth, though nearly or quite full grown. It curiously resembles a very young *P. penicillatus* (like LeConte's specimen for instance); and indeed, Prof. Baird was led, by its immaturity and defective state of preservation, to suggest that it might not improbably belong to *P. penicillatus*, though he proceeded to make it the basis of his *P. parvus*. It is, however, unquestionably a *Cricetodipus*, as I can affirm without qualification from inspection of the skull, which clearly shows the bulge of the mastoid back of an occipital emargination and other cranial characters diagnostic of *Cricetodipus*, to say nothing of the hairy soles and unlobed antitragus. I therefore accept the species as first clearly defined by Baird, without necessarily involving the question by including the doubtful animal of Peale.

As already suggested, the chances are that Baird was right in identifying his species with that of Peale, so that the name *Cricetodipus parvus* will stand. But should the contrary prove to be the case, and *Cricetodipus*, Peale, 1848, be conclusively shown to be a synonym of *Perognathus*, Maxim., 1839, a new name, generic and specific, will be required for the subject of the present article. The name *Otognosis* would be appropriate, in allusion to the facility with which the species may be distinguished from those of *Perognathus* by the structure of the ear. The present species may be called *O. longimembris*, as the length of the hind limbs and tail is its specific character in comparison with *O. flava*.

III. Genus **DIPODOMYS**, Gray.

Dipodomys, Gray, Ann. Mag. Nat. Hist. vii. 1840, 521, type *D. phillipi*.
Macrocolus, Wagner, Abh. K. Baier. Akad. xxii. 1845, type *M. halticus*.

A. *Generic Characters.*

Chars. (*a. cranial*). Skull light, thin, papery, depressed, broad behind with swollen curves, tapering in front; rostrum acuminate, produced beyond incisors; no interorbital constriction; palate plane; occipital surface deeply emarginate. Zygomata straight, thread-like, depressed to palatal plane; abutting against tympanics. Anteorbital foramina represented by a circular perforation of the front of the maxillaries. Large excavated lachrymals. Parietals triangular; an elongate interparietal embraced between forks of occipital. Squamosals reduced to small plates bounding the orbits posteriorly; other elements of the temporal bone extraordinarily developed, thin and bladdery, their sinuses of nearly as great capacity as the cerebral cavity; the mastoids especially enormous, constituting nearly all the occipital and the greater part of the superior (behind the parietals) surfaces of the skull;

the tympanics proportionally inflated, with large non-tubular orifice of meatus; the petrosals bullous, their apices in contact across the median line below the basisphenoid. Tympanics, mastoids, and parietals entering orbits. Occipital singularly reduced and narrowed, bent into three planes at right angles; supra-occipital bifurcate to inclose an interparietal; paroccipitals narrow, flange-like; basioccipital separated by a continuous fissure from petrosals. Mandible small, stout, with a very slight coronoid. (*b. dental.*) Superior incisors sulcate, connivent, pointing strongly backward; deeper than wide. Molars ($\frac{4}{4}$–$\frac{4}{4}$) simple, rootless. (*c. external.*) General form jerboa-like; hind legs very long, saltatorial. Tail rather longer than head and body, penicillate. Soles densely furry. Feet with 1st digit rudimentary, but bearing a claw. Eyes large and full; and ears large, orbicular. Snout produced, acute, pilous except a small nasal pad. Whiskers half as long as the whole body. Upper lip not cleft. Cheek pouches ample. Pelage long, and very soft. *Pictura* of body and tail bicolor. Size of a half-grown rat (*Mus decumanus*).

The skull of *Dipodomys*, whether taken as a whole or considered in several of its details, is of extraordinary characters not nearly matched outside the family to which it belongs. Many of its features are shared, to a greater or less extent, by *Perognathus:* but the unusual characters are pushed to an extreme in *Dipodomys*. The foregoing paragraphs merely indicate the more salient peculiarities; the skull is described in full beyond. The enormal development of certain elements of the temporal bone, and the results of this inflation upon the connections of the bone, and general configuration of the skull, are the leading characteristics. With this is co-ordinated the reduction of the squamosal and occipital, and the curious shape of the latter, as well as the anomalous abutment of the thread-like zygoma against the tympanic, and the contact of the petrosals with each other. In *Geomyidæ*, the temporals are of great size, but there is much less distortion of the topography of the parts, both squamosal and occipital maintaining ordinary characters. The temporal sinuses together are scarcely less capacious than the brain-cavity itself; the sense of hearing must be exquisitely acute, if co-ordinated with the osseous state of the parts.

Notwithstanding the singular condition of the skull of *Dipodomys*, resulting from the hypertrophy of certain parts, and the reduction of others, the relations with that of *Geomyidæ* are both close and clear; while *Perognathus* constitutes, in many respects, an excellent connecting link. Numerous coincidences could be pointed out, showing how the hint afforded by the presence in these two families of ample external cheek pouches is borne out in more essential features, notwithstanding the all but complete difference in general outward appearance.

B. *Cranial Characters of Dipodomys.*

As in other cases, it will be found most convenient to consider the skull as a whole first, and afterward to examine its individual bones. An immature specimen is preferable for the latter purpose, though many or most of the sutures persist to extreme old age.

In many respects, the skull of *Perognathus* approaches or closely resembles that of *Dipodomys*, but the family peculiarities reach their extreme development only in the latter. Comparative expressions used in the following paragraphs are to be considered exclusive of *Perognathus*, unless the contrary is stated.

The skull is much depressed; elongated and acuminate in front; very broad behind, where the width is nearly two-thirds of the total length; and, viewed from above, presents in general a triangular shape, with the lateral angles completely rounded off, and a deep emargination in the middle of the base. Zygomatic arches scarcely come into this view at all; the width of the skull midway being much less than the intermastoid diameter. The outline of the zygomata is perfectly straight; between the turgid mastoid region and the expanded plate-like zygomatic process of the maxillary there stretches the needle-like molar, depressed to the level of the palate. The outline of the orbits is a quadrate notch between the saliences just mentioned. There is no interorbital constriction; were it not for the laminar zygomatic expansion of the maxillaries and the bullous mastoids, the space between the orbits would be the broadest part of the skull. The attenuate acuminate rostrum springs directly opposite the broad zygomatic part of the maxillaries, and extends beyond the incisors; it is at least one-third of the total length of the skull. The postero-lateral aspects of the skull present enormous bulging masses rounded and somewhat ovate—the extraordinarily developed mastoids. The same swellings constitute also nearly all the occipital region, the median line of which is a deep emargination. This character is perhaps unique ; nothing like it is seen even in *Perognathus ;* its peculiarity is on a par with the immense rostral development in a walrus for example. The resulting figure, as one author has aptly remarked, bears a ludicrously close resemblance to the buttocks of the squatting human figure, the mastoids being the nates, the emargination being the cleft between, and the foramen magnum having an obvious suggestiveness. The whole surface of the skull is smooth, and gently convex in all directions. There are no ridges or roughnesses ; the sutures persist plainly visible in adult life ; and all the bones are remarkably thin and papery.

Viewed in profile, the skull shows notable features. The highest point is over the orbits, where the frontal and parietals are seen to be swollen ; thence the superior outline sweeps gently down to the occiput, and in the other direction proceeds in a nearly straight—if anything slightly concave—line to the tip of the snout. The great projection of the nasals beyond the intermaxillaries is well shown. The incisors in profile are seen to curve far backward as well as downward. The palatal outline is nearly straight, and declivous from before backward. Behind the palate a small pterygoid hook is seen ; but beyond this the whole outline is the inflated portions of the temporal bone hiding everything else. On the side of the rostrum midway, there is a large circular foramen, low down, but little above the palatal level ; this is the orifice corresponding to the "anteorbital" foramen, here singularly displaced. From its fellow of the opposite side it is only separated by a very thin vertical septum, apparently ethmoidal. This delicate partition being often broken through in prepared skulls, has occasioned the statement of the inter-communication of the two foramina. But I find the septum complete and intact in some specimens, and although a vacuity may very possibly naturally occur, such does not appear to be the rule. The orbits appear as a subcircular fossa, largely roofed over in front by the thin expanded zygomatic plate of the maxillary, and bounded below by the molar. Independently of its laminar maxillary portion, the zygoma is a slender, straight thread down to the palatal level, and abutting behind against the tympanic. The actual suture is squamosal, as usual, but there is a curious appearance of connection with one of the otic bones. In the general inflation of the posterior portion of the skull appears the large orifice of the meatus auditorius—a simple circular opening in the bullous mass.

Viewed from below, the general contour is substantially the same as that already noted from above; but many special parts claim attention. So great is the backward obliquity of the incisors that their faces show in this view with comparatively little foreshortening. The incisive foramina are a pair of contracted slits midway between the incisors and molars. The palatal surface in advance of the molars is much compressed; that between these teeth is broader and quite flat; its width posteriorly is little less than its length: it contracts somewhat anteriorly, where it is marked by a median ridge continuous with the septum between the incisive foramina. That part of the palate constituted by the palatal bones is marked with several minute foramina. The palate ends behind with a sharp median spur; on either side of this is an emargination, and external to this a large fossa perforated with two foramina anteriorly, and a third and much larger one behind. Beyond the palatals themselves, the walls of the posterior nares are continued by the pterygoids, which are small and hamulate, the hook abutting against the petrosals. Between the ends of the pterygoids, and right across the middle line of the skull, the apices of the petrosals meet each other, forming a bridge beneath the basisphenoid. The posterior parts of the skull, behind those already considered, are almost entirely occupied by the inflated elements of the temporal bone, between which lies the reduced basioccipital; this bone is narrowly acuminate, and is separated from the petrosals for its whole length by a continuous fissure, like that which, on the other side of the petrosals, separates these bones from the alisphenoid and squamosal. The foramen magnum appears partly in this view, flanked by the slight condyles, outside of which are seen the small distinct flange-like paroccipitals.

The posterior view of the skull shows little but the inflated mastoids, with a cleft between, mostly occupied by the large foramen magnum, around which the contracted occipital bone appears as little more than the rim of this foramen.

All the bones of the skull, as well as those of the top already so described, are thin and light; and the base of the cranium is remarkable for its extensive vacuities. Not only are the petrosals separated from their surrounding by great fissures on either side, rendering it almost necessary to their stability that they should abut against each other at their extremities; but there is also a singular separation of the alveolar portion of the maxillaries from the superincumbent parts, by a horizontal fissure; so that the palate appears as a sort of bridge between the fore and aft parts of the skull. Various peculiarities will appear more clearly from the following descriptions of individual bones.

The complex temporal "bone" will be first considered, since the prime peculiarities of the skull result from the wholly singular condition of hypertrophy under which several of the elements of this bone exist. The topography of the parts, and the connections of the bone are curiously remodelled as a consequence of the enormous inflation of the various otic elements, and corresponding reduction of the squamosal. In the absence of investigations into the development of the temporal bone, I can only describe it as it appears in the adult animal, using the terms "mastoid," "petrosal," and "tympanic" in their current acceptation, without reference to the primitive otic elements. Respecting the squamosal there is no difficulty; the petrosal appears under its usual condition of a bulla ossea. I regard as "tympanic" the inflated vesicle in which the meatus auditorius is pierced, which appears as a tubular prolongation of the bulla in the nearest allied family, *Geomyidæ*. The rest of the inflation, forming the greater part of the occipital surface and much of the roof of the cerebral cavity, I shall simply designate as "mastoid."

The two temporal bones together are little less bulky than all the rest of the skull. Excepting the reduced squamosal, all the elements are subjected to extraordinary inflation, as well as peripheral enlargement; they appear as papery vesicles, light, thin, and smooth, without ridges or angles, inclosing extensive antra, the collective capacity of which is scarcely less than that of the whole brain-cavity. These vaulted walls are supported by delicate bony arches or trabeculæ within, and imperfectly partitioned into several cavities by thin septa. The mastoid constitutes the greater part of these bulging masses. Its backward protuberance occupies nearly all the occipital surface of the skull on each side, the occipital bone being reduced to a narrow margin of the foramen magnum, sunk in an emargination between the mastoid and its fellow. On the top of the skull the mastoid similarly expands, filling the whole of the area usually occupied by the squamosal, and forming the greater part of the roof of the brain-case. Thus we have the curious circumstances of extensive mastoideo-occipital suture on top of the skull, and still more prolonged mastoideo-parietal suture—for the whole of the longest side of the right-angled parietal articulates with the mastoid; while so great is the anterior prolongation of this same bone, that a small part of it fairly enters the orbit, at the back outer corner of the latter. This extensive line of sutures with squamosal, parietal, and occipital bones respectively is distinct throughout; but the boundaries of the mastoid with other otic elements can only be inferred by certain lines of impression which appear to mark it off from petrosal and tympanic. Another point is to be considered here: the flattened and entirely superior portion of the mastoid (that which lies in the ordinary site of a squamosal) is incompletely distinguished from the occipital portion of the same bone by a line of impression running straight across from the margin of the meatus auditorius to the median line of the skull; and this mark corresponds to a nearly complete bony wall within the bone, which partitions off one sinus from another. This may be hereafter found to indicate the respective parts which certain primitive otic elements take in the formation of the "mastoid."

The petrosal, *i.e.*, the bulla ossea, is less peculiar than the mastoid; it is not more inflated than in very many mammals, and is chiefly remarkable for its contact with its fellow, and for the extensive uninterrupted fissures which separate it both from basi-occipital and alisphenoid. In general shape it is conoidal, moderately swollen, with the apex of the cone produced and curiously curved toward the median line of the skull, where it meets its fellow, forming a bony bridge beneath the basisphenoid. The claw of the hamular pterygoid rests against the end of the petrosal; and close to this there is an abutment of a piece of the sphenoid; otherwise, there is a great fissure betwixt it and the sphenoid. It is only in contact with occipital elements by means of the flange-like exoccipitals; the whole extent of the basioccipital being separated, as just said, by a large fissure. Posteriorly it is confluent with the mastoid, with imperfect indication of the precise line of union; exteriorly it is continuous, without appreciable indication of original distinction, with the special inflation in which the meatus is situated. This papery vestibule I presume to be analogous with the tubular meatus externus in *Geomyidæ* and elsewhere; the orifice is large, subcircular, and simply a hole without raised brim, pierced in the back upper corner of the bulb. Anteriorly the tympanic bulges so far as to form part of the orbit. While this special inflation is not otherwise distinguished from the general bulla ossea than by a slight constriction, it is remarkably divided off, above and behind, from the mastoid, by a strong line of impression, of which I shall say more presently.

Coincidently with the hypertrophy of these otic elements of the temporal, the squamosal is peculiarly reduced in extent, and pushed into the orbit, to which it is almost entirely restricted. It is simply a small irregularly shaped plate of bone lining the back part of the orbit, with a slight spur just exceeding the orbital brim in a little notch between corners of the frontal and parietal bones. The squamosal remains long discrete from all its surroundings. In full-grown though youngish animals the squamo-sphenoidal sutures may be readily traced—that with the alisphenoid just below the glenoid cavity, that with orbito-sphenoid within the orbit. The zygomatic process of the squamosal is of peculiar character: instead of a slender curved spur reaching around to grasp the malar, there is a short abrupt heel appressed against the tympanic, and to the roughened face of this heel the clubbed end of the needle-like malar is affixed. The relation of the parts is such that the zygoma appears to articulate behind with the tympanic—it actually has an abutment against that bone, though no real articulation with it.

From the lower back edge of the squamosal a curious thread of bone starts off and occupies the deep groove already mentioned as separating the tympanic from the mastoid. No break from the squamosal can be seen in this thread, which curls around the orifice of the meatus, still in the groove mentioned, and ends by a slightly enlarged extremity below and behind the meatus, exactly in the position of an ordinary "mastoid process." I am uncertain of the meaning of this. The end of this ligule or girdle of bone thus encircling the tympanic is in the site of the postero-lateral angle of the skull in *Geomyidæ*, in which such angle is formed by a corner of the squamosal; and the inference is self-suggestive that this delicate bony strap may really be squamosal —an edge of the squamosal persisting in situ after the rest of that bone has been crowded down into the orbit by the encroachment of the mastoid. Such a view, however, will bear further scrutiny. Even if a slender spur of actual squamosal does run out into the tympano-mastoid groove, it does not follow that the whole of the fold in this groove is squamosal; and certainly the enlarged extremity of this ridge, behind the meatus, has every appearence of an ordinary mastoid process.

Next after the squamosal, the occipital bone suffers most from the enlargement of the otic elements ; it is singularly restricted in extent, and presents itself in unique shape, compressed between the swollen mastoids. All the lateral occipital suturation is with the mastoid, excepting the basioccipital. The occipital lies in three planes, nearly at right angles with each other. The basi-occipital is horizontal, as usual upon the floor of the skull; the exoccipitals, with probably part of the supraoccipital, are perpendicular, behind ; the rest of the supraoccipital is horizontal again, on top of the skull. The basioccipital is wedge-shaped, and offers nothing very peculiar, excepting its entire disconnection from the petrosals between which it lies ; its sphenoidal articulation is just behind the joined apices of the petrosals. Exoccipitals appear as a pair of flaring flange-like processes, just outside the condyles, appressed against the otic capsules. The foramen is very large, subcircular, and mostly in the perpendicular plane of the bone. After inclosing this orifice, the bone rapidly contracts as it rises to the top of the skull ; this part is marked with a sharp perpendicular median ridge, and the edges of the bone being affected in coming into apposition with the swelling mastoids, there results a pair of deep narrow fossæ upon the face of the bone. The portion of the supraoccipital which mounts the top of the skull to there lie horizontal, almost immediately forks to embrace a small shield-shaped interparietal bone between its prongs. The ends of these prongs touch posterior corners of the parietals

The sphenoid bone is of rather small extent, owing to the situation of the squamosals in the orbit. It is widely fissured from the petrosals. The alisphenoid is very short; its termination may be seen in the jagged suture with the squamosal ; but short as it is, it only misses taking part in the mandibular articulation, since it extends to the margin of the glenoid. The orbito-sphenoid is comparatively smaller still, the place it occupies in *Geomyidæ* for instance being here largely occupied by the squamosal. The spheno-palatal suture may be traced in young specimens with a zigzag but still in general transverse course, from the side a little behind the maxillary alveolus across the middle line of the skull. There is no vertical orbital plate of the palatal bone; it all lies flat, and extends forward on the palate, wedge-shaped, but with square termination to a point opposite the first true molar. A backward spur of this bone forms with its fellow a sharp median process. There are various foramina already noted. The pterygoids are small claw-hammers abutting at their extremity against the petrosals.

The parietals are nearly right-angled triangles, with one side of mutual apposition along the median line of the skull, another transversely articulating with the frontal, and the hypothenuse postero-exterior, for the mastoid suture. The back corners meet the prongs of the occipital and slightly embrace the interparietal. The outer corner is prolonged into a spur which attains the brim of the orbit. And here the remarkable construction of the orbit by an unusual number of bones, may be noted. Following the brim of the orbit around we find—zygomatic process of maxillary; lachrymal; frontal; spur of parietal; back upper corner of squamosal; front end of mastoid; fore bulge of tympanic; zygomatic heel of squamosal; whole of malar, and so back to maxillary.

The portion of the frontal which appears on the surface of the skull is keystone-shaped and straight, broad behind to articulate with both parietals, narrowing anteriorly with nearly straight edge, and in front irregularly tranverse to accommodate its several rostral sutures. It sends a sharp spur on either hand into a recess between the maxillary and intermaxillary, and each intermaxillary causes a shorter, more obtuse re-entrance; the middle part articulating with the nasals is tranverse. The orbital portion of the frontal is a simple plate suturing behind with the orbito-sphenoid and squamosal, and in front with maxillary and lachrymal. The latter is of considerable extent, and much excavated; its edge appears upon the surface of the skull, margining the back of the zygomatic process of the maxillary.

The malar is very peculiar. In allied rodents, this bone is a stout arch, and very short, in consequence of the close approximation of the ends of the zygomatic processes of both maxillary and squamosal. But here there is, to all intents, no such squamosal process, and that of the maxillary ends abruptly: so the malar is a long bone, to complete the arch; it is a straight rod, of thread-like tenuity, with the fore end slightly elbowed and sharpened to lie by oblique suture against the maxillary, on the inner side, and the hind end slightly clubbed to suture by a roughened flat surface with the heel of the squamosal; and such are the relations of the parts, that the malar seems to run against the otic capsule. The depressed position of this bone, which lies down on the level of the palate, has been already noticed.

The maxillary bone, with a general shape and connections which scarcely require notice, has two peculiarities; one of these is the singular position of the "ante-orbital" foramen;—here a large circular perforation at the anterior border of the side of the bone, altogether remote from the orbit. It lies above and even in advance of the incisive foramina. Its fellow is only separated by the width of the compressed muzzle; there is a thin partition, probably ethmoidal, between them. The other peculiarity of the mastoid is the unusually extended and vaulted zygomatic plate, which thus roofs over a considerable part of the orbit. This inflated lamina suddenly comes to a point where the malar joins it. Its suture with the frontal, or the surface of the skull, is a straight line.

The incisive foramina, in *Geomyidæ*, are wholly in the intermaxillaries; in *Dipodomys* they are formed by both bones, the maxillaries bounding about a third of their periphery. The nasal spur of the intermaxillary extends upon the forehead a little way beyond the ends of the nasals; while a sharp process of the frontal separates it from the maxillary. The alveolar portion is remarkably curved backward, to suit the trend of the incisors, and a strong alveolar plate separates the teeth for about half their length.

The nasals are chiefly notable for their length and tenuity; they reach far beyond the incisors; the back half is linear and superficial; anterior to this, where the intermaxillaries bend down, they become somewhat volute, prolonging a semi-tubular snout. Within, delicate turbinal scrolls are seen extending to the orifice. The nasals are supported, nearly to their ends, by small intermaxillary spurs.

The mandible remains for consideration. This bone is remarkably small, considering the size of the rest of the skull, and is further notable for its slight elevation posteriorly, its short incompleted symphysis, and the thickness of the body of the bone. The coronoid process is remarkably small, not nearly attaining the level of the condyle, at the root of which it appears as a minute backward sloping prickle-like spur. The condyloid ramus itself is small, compressed and oblique. The principal feature of the bone is an immense flaring lamina which arises as a verge upon the back part of the lower border of the body of the bone, and expands obliquely outward and upward, with a peculiar twist. This plate-like process is longer than the condyloid ramus itself, and ends in an acute point, so that the back of the jaw appears two-pronged. There is a deep pit between the alveolus and the root of the coronoid plate. The mental foramen is conspicuous upon the outside of the jaw close to the incisors. The small size and lowness of the jaw is seen in the peculiarly retreating chin of the species; and it is probable, especially to judge from the condition of the coronoid, that the biting power is comparatively slight.

The vertebral formula of *Dipodomys ordii* is given by Baird as 7 cervical (with anchyloses of 2d, 3d, and 4th), 12 dorsal, 9 lumbar, 4 sacral, and 28 caudal, = 60; there is doubtless an individual variability of several of the caudal segments. There are five metacarpals and metatarsals, though the inner one of each is reduced. There are perfect clavicles. The tibia and fibula are united below.

C. *Dental Characters of Dipodomys.*

The dentition of Dipodomys is simple. Of the four molar teeth above and below, the anterior one is a premolar, being preceded by a deciduous tooth, which, however, is long persistent. This one is rooted and with a more complicated crown than the rest; the molars proper are rootless and perennial. In both jaws, the set of the molars is very oblique; in the upper, the anterior tooth bends strongly backward, and the posterior one somewhat forward; thus bringing their crowns in close apposition, though their roots are divergent. It is the same in the lower jaw, though the greatest obliquity there is in the strong forward set of the posterior tooth. The teeth are all simple compressed prisms, broader in the transverse than in the fore and aft direction. In the worn state, the crowns of the two intermediate molars are simply elliptical; that of the anterior molar is rather a spherical triangle, with convex posterior, and two concave anterior sides; the back molar is small and subcircular. It is much the same in the lower jaw. The crowns show simply the brim of enamel, with a depressed island of dentine. In the unworn state, however—such as may be observed in specimens with the milk tooth still in position—there are some decided differences. The outer border of the two anterior teeth shows a deep nick, where there is a reëntrant fold of the enamel; and the back molar has a similar indentation of the inner side. This diminishes regularly with the continuous growth of the incisors, until the crowns are ground down beyond the extent of the infolding, when it ceases to appear and the plain elliptical form of the crown is assumed.

The incisors are small and delicate, in both jaws, contrasting with the stout scalpels of *Geomyidæ*. The superior pair are much compressed, being narrower than deep, and strongly curved. Their face is marked by a deep median groove, and the outer portion is rabbeted away, so that the groove is visible in a profile view. The teeth emerge from the sockets some distance apart, separated by an intervening alveolar plate, but they are convergent, and their tips are in close contact. The under incisors, no larger than the upper ones, are of much the same general character, but are not grooved, the smooth faces being simply rounded off. Their roots make a slight protuberance at the outside of the base of the condyloid ramus.

D. *External Characters of Dipodomys.*

The general configuration of this animal is lithe and graceful, indicating agility and incessant activity. The body is slender, the neck distinct; the head large with tapering muzzle; the eyes and ears are prominent; the fore limbs small and neat, indicating predominance of prehensile over merely gressorial faculties; the hinder limbs are of great size, as perfectly saltatorial as those of a kangaroo or jerboa; and the tail is longer than the body. Notwithstanding the saltatorial nature of the animal, there is none of that preponderance of organization of the hinder parts witnessed in the kangaroo, with its massive haunches and enormous tail; the whole body is equally slender, the leaping power being manifested in the enlargement of the hind limbs alone; the tail, too, is slender throughout.

The head is distinguished from the body by a well-defined cervical constriction. The broad high occipital region dips suddenly down to the nape. The upper corners of the head, upon which the ears rest, are elevated and wide apart; the top of the head has in general a triangular shape, tapering from each ear to the snout with but slight swelling in the orbital region, and is quite flat across, with the most gentle longitudinal curve in the frontal region, and nearly straight nasal profile. The muzzle is acuminate, and much produced, appearing longer still in consequence of the remarkably small retreating chin. The muzzle is entirely hairy, excepting a small nasal pad; this shows a median depression, but there is no cleft of the upper lip, the whole of which is thickly clothed with stout hairs, that form a dense fringe drooping over and concealing the superior incisors. The lower lip is thickened and densely hairy; and there is also a hairy commissure of the upper lip *behind* the superior incisors, so that these teeth are shut out of the true (mucous-lined) buccal cavity. For the rest, the lips seem to come together vertically instead of horizontally, closing the oral aperture sideways, though of course the buccal cavity or mouth proper shuts as in ordinary mammals. All this is essentially the same as in the *Geomyidæ;* and further, as in these last, there is a great pouch on each side of the head, entirely disconnected with the mouth, formed of a duplication of ordinary integument, hairy throughout. These sacs will admit the first joint of one's little finger; they run the whole length of the head, but not beyond to the shoulder. In relative capacity, they about equal the least developed pouches of *Geomyidæ*—those of *G. hispidus* for instance. The opening is crescentic; the inner limb of the semilune being the skin of the jaws, while the outer limb is a free fold or border arising on the side of the snout half way between nostrils and incisors and a little back of both, and curving loosely around to the side of the under jaw near its middle.

The whiskers are extremely numerous, and some of them are very long. A bunch of short fine ones springs from the extremity of the snout, on each side, by insensible lengthening of the fringe of hairs that clothe the upper lip. Others grow in the usual site, and the longest of these usually exceed half the total length of the body. There are other long slender bristly hairs in weak clumps about the eyes and ears, and a bunch of short antrorse bristles springs from the chin. The eyes are large and prominent, in life remarkably soft and expressive, in striking contrast to the little piggish peepers of the *Geomyidæ;* in consequence of the production of the muzzle, they are situate much nearer to the ears than to the nose, and rather above a line connecting the two. The ears, similarly, are large and "leafy," appearing the more prominently because they rest upon the most protuberant part of the skull. When pressed out flat, the auricle is nearly orbicular. In the natural state, the fore border is largely folded over, the duplication extending from the extreme root to the highest point of the ear, and representing about one-third of the width of the ear. This fold causes a slight pointing of the ear. The posterior border is more rounded than the anterior; and within its base is developed a large conspicuous obtusely angular antitragus, so broad that its inner edge is extensively overlapped by the fold of the anterior border of the auricle. A fringe of long hairs springing from the base of the anterior fold is directed backwards over the antitragus; otherwise the auricle is closely and completely pilous on both sides, the hairy clothing of the open part of the concavity being heavier than that on the back of the ear.

The fore limbs are shortened, in sacrifice of locomotive ability to increase of prehensile faculty. The arm and forearm are stout; the latter tapers very abruptly and contracts to a delicate wrist and very small hand. There are four perfect digits, and a rudimentary thumb; the longer digits rather exceed, even excluding their claws, the length of the hand proper (metacarpus); the 3d and 4th are approximately equal in length and longest; the 2d and 5th are successively reduced a little in length; the 1st is a mere stump; its claw a knob; the other claws are well formed, slender, compressed, acute, little curved, nearly as long as their respective digits. The back of the whole hand is pilous, and longer hairs fringe the sides of the digits; but the palm is naked, minutely tubercular throughout, these numberless little elevations showing no recognizable special distribution. The hand ends behind with an enormous smooth bulb, a little to the inner side, and with a smaller external bulb, likewise smooth, separated from the main one by a hairy isthmus.

The hinder limbs offer the opposite degree of development. While the fore, from the elbow outward, is only a fourth of the total length, the corresponding measurement of the hind limb, that is, from the knee outward, is three-fifths or more of the whole length, and the hind foot alone is about one-third of such dimension. There is no noticeable bulkiness of the haunches, but the hams are massive, flattened-conoidal, suddenly contracting at the lower third, where the crus is of much less calibre than the foot. There is a prominent heel, and obvious tendo Achillis. The metatarsus is subcylindrical, widening to a broad foot with strong digits. The whole foot reminds one of a rabbit's; a resemblance heightened by the dense furring of the whole sole, excepting a small calcaneal tuberosity. There are four perfect digits, of which the 3d is the longest, the 4th and 2d are successively a little shorter, and the 5th is much shorter still; while the 1st is a mere rudiment, entirely removed from the rest, nearly half way up the foot. This bears a stumpy claw; the other claws, though small, are well formed, stout at base, compressed, little curved, and acute.

The tail exceeds the head and body in length, even without the penicillate tuft of hairs at the end, which projects an inch or more beyond the vertebræ. It is of somewhat quadrangular shape, the flattening being especially appreciable on the under side, and is of nearly uniform calibre throughout, springing directly from the body without any basal enlargement, and but little taper at the end. It is closely and uniformly clothed with rather stiffish hairs for most of its length, the hairs gradually lengthening on the further half into the well-formed terminal brush.

The pelage differs from that of the allied genus *Perognathus* in its softness, length, and fineness, and has a silky gloss in life. It also lies with extreme smoothness on the colored areas of the body; the hairs are plumbeous basally, as usual; on the white parts they are unicolor to the roots.

In the male, during the rutting season, there is an immense perinæal enlargement, strictly circumscribed from neighboring parts, due to the turgidity of the virile organs within. The anus presents in the centre of this enlargement with the sheath of the penis just in front, quite prominent. There is a comparatively large os penis. In the female the anal and genital orifices are in still closer relation; the ostium vaginæ is prolonged in front into a dependent lobe, occupying the site of the penial sheath of the male.

The pattern of coloration of *Dipodomys* is peculiar and diagnostic of the genus—the striped tail and white band across the hips are not found elsewhere. All the upper parts are fulvous or tawny brown, closely lined with fuscous to a greater or less extent and intensity. Some specimens, with the least dusky, are very light colored—a pale yellowish cinnamon; others approach mouse color, but even in the darkest specimens the decided fulvous shade appears at least upon the sides. All this colored portion is plumbeous beneath, excepting a little space along the middle of the sides, where basally white hairs have the tawny tips. All the under surface of the animal is snow-white to the roots of the hairs. The line of white begins on the side of the muzzle and runs along the side of the head, including the pouch; the entire fore limb is white; the stripe rises a little on the side of the belly, and thence runs along the middle of the outside of the hind limb from the knee to the heel, sending a sharp white stripe from the knee across the haunches to the root of the tail. The hind foot is white, with a dusky stripe along the sole. The whiskers are partly black, partly colorless; their conjoined bases make a conspicuous black spot on each side of the muzzle. There is some whitishness in most cases—sometimes altogether wanting—about the eye, and a white patch just back of the ear. The front of the ear is sometimes light. The tail is dusky-slaty, or sooty-brown, or even blackish, with a broad, firm white stripe on each side from base to near the tip. At the extreme base, the white usually encircles the tail; at the other end, the color of the tuft is altogether indeterminate; sometimes the white lateral stripes give out before reaching the end, leaving the tip entirely dark; sometimes the white extends to the very end of the brush, cutting off the dark altogether; and moreover, the white may encroach upon the under side, cutting off the dark from more than half the tail; oftener, the brush is mixed dusky and white. Thus the tail may end either white or dark, or a mixture of both. It is as variable in this respect as the tail of a skunk. The eyes are lustrous black; the nose pad and palms flesh colored; the claws pale.

In old museum specimens, long exposed to the light, the above description may not be verifiable as regards any of the darker markings and shades mentioned; for all the colored portions of the fur finally fade to a dull, pale brownish-yellow, or even dingy yellowish-white. Under such circumstances, even the rich purplish chestnut of a mink, for example, ends in dingy whitish.

Having thus fully exposed the general characters of the animals of this genus, it remains to consider the mode in which and extent to which the genus has become differentiated into recognizable forms, if there be more than one. Various species have been proposed and recognized. As these rest mainly upon size and proportions, these points will be first discussed.

The following tables of measurements of a series of *Dipodomys*, fresh and alcoholic, will serve to show whether or not the two species, commonly supposed to be distinguished by size and proportions, intergrade in these respects. The specimens are arranged without reference to locality, according to the chief point in question, namely, length of tail.

Measurements.

Current Number.	Locality.	Sex	From tip of Nose to				Tail to end of		L'gth of		Nature of Specimen.
			Eye.	Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore ft.	Hind ft.	
4970	Cape St Lucas........	♂	0 90	1.45	1 55	3 50	5.00	....	....	1.35	Alc.
8436	Ft. Whipple, Ariz	♂	....	....	1.90	4 25	5.00	6 00	....	1.55	Fresh.
4871	Cimarron, N. M......	♀	1.00	1.55	1.75	4.50	5.00	5 75	....	1.55	Alc.
4970	Cape St. Lucas........	♀	0.85	1 35	1.45	3.50	5.25	....	....	1.40	"
8437	Ft. Whipple, Ariz	♂	....	....	....	4.50	5 25	6.25	....	1.50	Fresh.
9478	(Unknown)...........	♂	1.00	1.40	1.55	4.75	5.50	....	....	1.60	Alc.
4970	Cape St. Lucas........	♀	0.85	1.40	1.50	3 75	5.75	6 75	....	1 40	"
4970	" "	♂	0 95	1.50	1.60	3.75	5 75	6.75	....	1.40	"
4970	" "	♂	0 90	1 45	1.55	3 75	5.75	6.75	....	1.45	"
7349	(Unknown)...........	..	....	....	....	....	5.75	6 50	....	1.60	"
7344	Platte Valley.........	♀	0.90	1.40	1.60	4.50	5 75	7 00	....	1 55	"
2627	Ft. Reading, Cal......	♂	0 90	1.35	1 55	3.35	5 80	....	....	1.60	"
2626	" "	♂	0 80	1.25	1.40	3.25	6 00	....	....	1.60	"
2628	"California".........	..	....	....	....	5 00	6.10	7 00	....	1.60	"
10725	Monterey.............	♂	1 00	1.60	1.75	5 09	6.75	7.75	....	1.70	"
7348	Ft Tejon, Cal........	♀	1.00	1 60	1.80	4.25	7 00	7 75	....	1.70	"
....	"Rocky Mts."........	♀	0.95	1.45	1.70	4.50	7.00	8.00	....	1.70	"
....	Average	..	0.92	1.44	1.61	4.06	5.79	6.85	....	1.58	"

The foregoing table of measurements of only 17 specimens, all adult, suffices to prove an uninterrupted gradation in size of every part of the body and its members. There is no break whatever in any of the absolute dimensions. The specimens range, by minute fractions of the inch, from 3.25 to 5.00 inches in length of head and body, averaging about 4.00. The tail vertebræ range from 5.00 to 7.00 inches, averaging about 5.75; with the hairs the tail is from 5.75 to 8.00 inches, averaging a little less than 7.00. The hind foot runs from 1.35 to 1.70, settling at an average of 1.58. It will be observed that the lengths of tail and feet bear no constant ratio to each other, some specimens with relatively smallest feet having relatively the longest tails. It will further be evident that absolute lengths of tail and feet are not indicative of geographical limitations; for the specimens which are arranged in the table with reference to absolute length of tail-vertebræ (with which absolute length of feet is approximately correspondent) show complete intermixture of localities. Measurements of a hundred or a thousand specimens would of course only tend to place these facts in stronger light. It may be safely stated as a fact, then, that differences in absolute size, either of the body or of any of its members, are not available for distinction of two species; and furthermore, that no set of absolute dimensions is correlated with geographical distribution.

Nevertheless, one cannot fail to be struck, in examining the table, with the extraordinary discrepancy in *relative* length of the body and tail. In No. 4871, for example, the tail (vertebræ) is only half an inch longer than the head and body (4.50–5.00); that is to say, it is but *one-ninth* of the head and body length longer. In No. 2626 the tail is two and three-quarter inches longer than the head and body; that is to say, almost *twice* as long. It would appear improbable that such unusual difference as this should not signify something more than mere individual variability. In order to discover whether or not the *proportionate* (as distinguished from absolute) dimensions of body and tail may not lead to some tangible result, the following table is constructed, in which the same specimens are arranged geographically. It is necessary to exclude four of them however (Nos. 9478, 7349), from unknown localities, together with the two respectively marked "California" and "Rocky Mts.," as I have reason to believe that these indications of locality are not reliable.

Measurements.

Rocky Mountain Region.				Coast Region.			
	Head and body.	Tail Vert.	Hind foot.		Head and body.	Tail Vert.	Hind foot.
Arizona............	4.25	5.00	1.55	Capt. St. Lucas ...	3.50	5 00	1.35
"	4 50	5.25	1 50	" " ...	3 50	5.25	1.40
New Mexico	4.50	5.00	1.55	" " ...	3.75	5 75	1.40
Platte Valley......	4.50	5 75	1.55	" " ...	3.75	5.75	1.40
				" " ...	3.75	5.75	1.45
				Ft. Reading.......	3.35	5.80	1.60
				"	3 25	6.00	1.60
				Monterey.........	5.00	6.75	1.70
				Ft. Tejon	4 25	7.00	1 70
Averages	4.43	5.25	1.53	....	3.78	5.89	1 51

This second table, as far as it goes, leads to some tangible and practical results. More specimens would undoubtedly modify the exact figures, but would, I think, only confirm the general statement, that there is a decided difference in relative length of head and body and of tail, between specimens from the interior and those from the coast region. This substantiates, in effect, the broad distinction established by Baird in 1857, though the details given by that author require qualification.[1]

In the animals from the interior, with an average length of nearly 4.50 inches, the tail is scarcely or not an inch longer than the body; that is to say, it is about one-fourth as long again as the head and body.

In the coast region specimens, with an average length of less than 4 inches, the tail is about two inches longer than the head and body; that is to say, it is if anything more than half as long again as the body.

The feet do not present any very tangible characters. We find them of all sizes coupled with different extremes of tail length. Nevertheless it will be observed that the Cape St. Lucas specimens alone of the coast series present small feet, under 1.50; and that without these, the coast series would show a length of foot of 1.60–1.70, thus correlated with the greater length of tail.

To these data may be added some others, tending to substantiate the differentiation of the forms of the genus. The western animal averages smaller, and of more slender build, with larger

[1] M. N. A. 1858, p. 409.—"Whatever the number of species, all hitherto detected in North America belong to the two following sections:—

"Section I. Hind foot not exceeding 1.50 inches, usually appreciably less; about one-third the length of head and body. Tail vertebræ about $1\frac{1}{4}$ times the length of head and body in nature; rarely exceeding 5 inches, never $5\frac{1}{4}$. *D. ordii.*

"Section II. Hind foot, 1.60 inches, sometimes more; always considerably exceeding 1.50; almost half as long as head and body in the first specimens. Tail vertebræ $1\frac{3}{4}$ times the length of head and body, always exceeding $5\frac{1}{4}$ inches; usually from 6 to 7 inches. *D. phillippi*, *D. agilis.*"

The proportions of body and tail here laid down I verify exactly, though the limits of extremes given require to be enlarged. On the contrary, the statements made respecting the feet do not hold upon examination of more material. In fact the Cape St. Lucas are the shortest-footed animals of the whole series: and in one very large Texas specimen (dry), not given in the table, the foot is almost 2 inches long.

ears, and longer limbs, and especially longer tail. It is darker in color, the prevailing tone being a mouse-brown overcast with tawny or fulvous. The animal from the interior is larger, and noticeably more stoutly built, with smaller ears, and shorter limbs, and particularly shorter tail. It is lighter in color, the prevailing tone being the peculiar tawny or fulvous of the genus, deepened somewhat on a dorsal area with mouse-brown.

These are simply observed matters of fact, not open to question. Certain differences which actually exist, as well as the insensible blending of these differences, may both be fairly signalized by the following formulæ of nomenclature and description, in which the various names which have been proposed are relegated to their proper place, covering diagnosis of typical (*i.e.* extreme) characters, and indication of the region in which such form more especially prevails:—

Dipodomys phillipsi,[1] Gray.

Dipodomys phillippii, Gray, Rep. Brit. Assoc. 1841, 70; Ann. Mag. N. H. vii. 1841, 521. Real de Monte, Mex. (Type of genus.)—Gray, Am. Journ. Sci. xlii. 1842, 335.—Wagn., Suppl. Schreb. iii. 1843, 295.—Le C., Proc. Acad. Nat. Sci. Phila. vi. 1853, 224. (Sacramento Valley, Cala.)—Gieb., Säug. 1855, 600. (Compiled.)—Baird, M. N. A. 1857, 442. (California, etc.)—Coop. and Suckl., P. R. R. Rep. xii. 1859, Mamm. pp. 100, 127.

Dipodomys philippi, Schinz., Syn. Mamm. ii. 1845, 93. (Compiled from Gray.)

Dipodomys phillippsii, Aud. and Bach., Q. N. A. iii. 1853, 137, pl. 130. (From Gray's type.)

Dipodomys phillipsii, Gray, List. Mamm. Br. Mus. 1843, 120.—Gerr., Cat. Bones Br. Mus. 1862, 173.—Gray, Proc. Zool. Soc. 1868, 200.

Dipodomys phillippii, Baird, P. R. R. Rep. x., 1859, Williamson's Route, Mamm. p. 82.

Macrocolus halticus, Wagn., Abh. K. Baier. Akad. xxii. 1845, 319; Arch. f. Naturg. 1846, 172.—Giebel, Säug. 1855, 599. (Compiled.)

Dipodomys agilis, Gamb., Proc. Acad. Nat. Sci. Phila. iv. 1848, 77. (Los Angeles.)—Le C., Proc. Acad. Nat. Sci. Phila. vi. 1853, 224.—A. and B., Q. N. A. iii. 1854, 339. (Compiled).—Gieb., Säug. 1855, 600. (Compiled.)—Bd., Proc. Acad. Nat. Sci. Phila. 1855, 334 (San Diego); M. N. A. 1857, 414, pl. 9, f. 1.—Gray, P. Z. S. 1868, 201.

Dipodomys heermanni, Le C., Proc. Acad. Nat. Sci. Phila. 1853, 224. (Sierra Nevada.)

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[1] This name is found variously spelled by authors, as well as by Gray himself; but if, as stated by Gray, the species was named after John Phillips, the rendition here adopted appears to be most correct.

Dipodomys heermannii, Baird, M. N. A., 1857, 415. (Compiled.)
Dipodomys hermannii, Gray, P. Z. S. 1868, 201. (Compiled.)
Dipodomys wagneri,[1] Le C., Proc. Acad. Nat. Sci. Phila. 1853, 224.—Bd., M. N. A. 1857, 415. (Compiled.)—Gray, P. Z. S. 1868, 201. (Compiled.)

Hab. Pacific region at large, from Washington Territory to Cape St. Lucas; Nevada; and portions of Mexico (Real del Monte, *Phillips*). Specimens examined from Fort Walla-Walla, Cape St. Lucas, and numerous localities nearly throughout Upper and Lower California.

Chars. Small: rather under than over four inches in length of head and body, with slender shape, large ears, long limbs, and especially long tail. Tail vertebræ 2 inches (more or less) longer than the head and body, bearing a proportion of about (rather more than less) 1.50 to 1.00. Coloration heavy: upper parts rather dark mouse-brown or even dusky in general tone, lightened, especially on the sides, with the peculiar tawny shade of the genus.

This animal served as the type of the genus, described by Gray in 1840. It figures in various treatises, mainly under compilation. Audubon gave an excellent illustration, taken from the type specimen. *Macrocolus halticus* of Wagner, described soon afterward, is, as suggested by both Gray and Baird, undoubtedly the same animal, though no mention is made of the pouches. Some other unquestionable synonyms are cited above.

Dipodomys phillipsi ordi, Woodh.

Dipodomys ordii, "Woodh.," LeC., Proc. Acad. Nat. Sci. Phila. vi. 1853, 224. (Notice of Woodhouse's type).—Woodh., Proc. Acad. Nat. Sci. Phila. vi. 1853, 235; Sitgr. Rep. Expl. Zuñi and Col. R. 1853, 50, pl. 4. (El Paso, Texas.)—Aud. and Bach., Q. N. A. iii. 1854, 317. (Compiled.)—Baird, M. N. A. 1857, 410, pl. 5, f. 1; pl. 21, f. 1; pl. 51, f. 1, 2.—Baird, P. R. R. Rep. x. 1859, Gunnison's and Beckwith's Route, Mamm., p. 8.—Baird, P. R. R. Rep. x. 1859, Whipple's Route, Mamm. p. 14.—Hayd., Trans. Amer. Phil. Soc. xii., 1862, p. 147. (Niobrara R.)—Gerr., Cat. Bones Br. Mus. 1862, 175. —Coues, Am. Nat. i. 1867, 395. (Habits.)—Gray, P. Z. S. 1868, 201.—Allen, Proc. Bost. Soc. xvii. 1874, 42. (Yellowstone.)
Dipodomys montanus, Baird, Proc. Acad. Nat. Sci. Phila. vii. 1855, 334.

Hab. Rocky Mountain region at large, and somewhat eastward, from the region of the Yellowstone into Mexico. Limit of southern

[1] The ascribed locality is obviously and unquestionably erroneous. The label "James Reed, South Carolina," like that on some other specimens of various animals I have seen, indicates the donor and *his residence*.

extension not precisely known. Specimens examined from the Yellowstone, Powder, Niobrara, Platte, and Arkansaw Rivers; from various localities in Texas, and nearly throughout New Mexico and Arizona; from Sonora, Durango, and Coahuila, Mexico.

Chars. Larger: rather over than under 4 inches in length of head and body, with (comparatively) stout shape, small ears, short limbs, and short tail. Tail vertebræ one inch (more or less) longer than the head and body, bearing a proportion of about (rather less than more) 1.25 to 1.00. Coloration light; upper parts nearly uniform tawny-brown of the shade peculiar to the genus, darkened a little with mouse-brown on a dorsal area.

This form of the genus appears to have been first noted by Dr. Woodhouse, in 1853, all the other names being referable to the other. His specimens were from El Paso. The known limits of its dispersion were enlarged in 1857 to include the region of the Platte; while specimens still more recently examined show that it extends northward to the Yellowstone at least, further east in Dakota, Nebraska, and Kansas than was formerly supposed, and even reaches to Arkansas, where specimens were lately procured at Fort Cobb.

JULY 6.

The President, Dr. RUSCHENBERGER, in the chair.

Thirteen members present.

A paper entitled "Descriptions of new Species of American Land and Fresh-water Shells," by Jas. Lewis, M.D., was presented for publication.

On Orthosia ferrugineoides.—The Secretary read the following communication from A. R. GROTE:—

Mr. Morrison gives the synonymy of *Orthosia ferrugineoides* on page 66 of the Proceedings of the Academy of Natural Sciences of Philadelphia, I think quite incorrectly. Whether *bicolorago*, Guen., is this same species or not seems doubtful. On the other hand, *spurcata*, Walk., is founded on blackish specimens. In the British Museum, the ordinary *ferrugineoides* was determined as *bicolorago*; hence in earlier papers I have spoken of the species under this name. If they are the same, then *bicolorago* has priority for the species. A name proposed for a variety cannot obtain against a name proposed for a species. The most important reference, that of the species to its proper genus, is incorrectly omitted by Mr. Morrison. *Orthosia ralla* is, also, incorrectly made synonymous. *O. ralla* is a smaller species with pellucid yellowish, unclouded hind wings. The t. p. line is shaded and dentate in *ralla*, dotted in *ferrugineoides*. The subterminal line is represented by distinct interspaceal spots in *ralla*; in its ally it is linear, faint, shaded, of the usual undulate shape. The fine wings are more angulate in *ralla*, and the under surface paler and less noticeably marked. The synonymy of *ferrugineoides*, until we have more certainty as to what *bicolorago* is, will stand as follows:—

Orthosia ferrugineoides.

Xanthia ferruginea var. *ferrugineoides*, Guen., Noct. i. 398.
Xanthia bicolorago, Walk., C. B. M. Noct. 464.
Orthosia ferrugineoides, Grote, Bull. Buff. Soc. Nat. Sci. 2, 124.
var. *spurcata*, Walk., C. B. M. Noct. 749.
? *Xanthia bicolorago*, Guen., Noct. i. 397.

Hab. Eastern and Middle States and Canada.

July 13.

The President, Dr. Ruschenberger, in the chair.

Eighteen members present.

A paper entitled "Fasti Ornithologiæ Redivivi, No. 1, Bartram's Travels," by Elliott Coues, M.D., was presented for publication.

Pelvis of Hadrosaurus.—Prof. B. Waterhouse Hawkins referred to his remarks of last summer regarding the position of the so-called clavicles of *Hadrosaurus*. Having drawn a figure of the skeleton, he explained the impossibility of disposing of those bones in the position of clavicles. A comparison of the skeleton of *Hadrosaurus* with that of the *Ostrich* was made, and the conclusion drawn that the ischiatic position assigned to the bones in question in the restoration made for the Smithsonian Institution was unwarranted.

Prof. Cope stated that he had lately obtained a metatarsal bone of *Lælaps* which confirmed the views of Prof. Hawkins as expressed in his restoration of that animal made during his engagement at the Central Park, New York.

July 20.

The President, Dr. Ruschenberger, in the chair.

Nineteen members present.

Papers entitled "Report on the Reptiles brought by Prof. James Orton from the Middle and Upper Amazon and Western Peru," by Edw. D. Cope; and "Note on the Ichthyology of Lake Titicaca," by Edw. D. Cope, were presented for publication.

Influence of Nutrition on Form.—Mr. T. Meehan remarked that the influence which nutrition, in its various phases, had on the forms and characters of plants was an interesting study; and in this connection he had placed on record in the Proceedings of the Academy, that two species of *Euphorbia*, usually prostrate, assumed an erect growth when their nutrition was interfered with, by an *Æcidium*—a small fungoid parasite. He had now to offer a similar fact in connection with the common Purslane—*Portulaca oleracea*—one of the most prostrate of all procumbent plants, which, under similar circumstances, also became erect.

The Drosera as an Insect Catcher.—Mr. Thomas Meehan referred to a discussion before the Academy recently in which the question occurred, whether those plants which had contrivances for catching insects made any nutritive use of the insects so caught. It had been suggested that experiments made in England with plants under bell-glasses and free from insects, were quite as healthy as those which had had insects regularly applied to them, and this was argued to prove that the plants were not actually insect eaters.

In a recent botanical trip to New Jersey, he had found in Atlantic County, about five miles from Hammonton, three species of Drosera; *D. filiformis*, *D. longifolia*, and *D. rotundifolia*, all growing near each other in immense quantity. All of these species had insects of numerous kinds attached to them. Large numbers of plants had no insects. The species with the largest number of plants having insects on them, were in the order as above named. The insects are held by the pin-like glandular hairs, which seem to lean in from all sides towards the insect—as if, from its struggles to escape, drawn in—and thus securely holding it. The remains of the insects which have been caught, seem to continue attached to the plant for a long time; and thus can be seen which plant has had the benefit of insect food—if food it be. No difference, however, in health or vigor could be traced between those which had had insects and those which had had none. Mr. Meehan did not, however, think that these observations, or experiments founded on anything they suggested, would settle the question of nutrition. Among ourselves there were discussions as to whether people were healthier as vegetarians or flesh eaters, while figures showed little difference, if any, either way. A plant might feed on insects when it could get them, and yet be no healthier than those which had to get along as other plants did. It was necessary, however, to the theory advanced by those who believed the insect catching were really insect eating plants, to show that some superior advantages favored the insect catchers. It was believed that the power to catch insects was a developed one—a power not possessed by their predecessors—and developed according to the law of natural selection. Unless insect catching can be shown to be an especial advantage, there was nothing to select. At any rate, his observations on the Drosera only showed that all the plants, whether with insects or with none, were equally healthy.

Some observers have recorded that there is a motion of the leaves as well as of the glandular hairs in the effort to catch insects; only one fact was noticed bearing on this question, one leaf of a Drosera filiformis had coiled over towards its upper surface from the apex, and held an insect in its folds.

On the Indian Tribes of Costa Rica.—Mr. Gabb called attention to the recently published work of Bancroft on the Indian tribes of the Pacific slope, and stated that, while he did not profess to criticize it in other respects, he felt bound to protest against all of that portion relating to the Indians of Costa Rica.

Heretofore, nothing reliable had been published on the subject, because nothing was known with certainty. The scanty literature of the subject has been based rather on untrustworthy reports than on personal observations. Mr. G. has recently completed a very detailed exploration of the region known under the political name of Talamanca in Costa Rica, and has devoted much time and care to the subject of its Indianology. The map of Bancroft is worse than useless. He places the "Talamancas" in the northeast portion of the Republic, the "Blancos" in the centre, exactly where the 150,000 of the Spanish inhabitants live, "Orotiñans" along the coast of the Gulf of Nicoya, the "Valiertes" and "Ramas" in Talamanca, and the "Guetares" to the south of the "Orotiñans." The "Guatusos" are the only tribe that is placed with even approximate correctness. The "Valientes" live in the Province of Chiriqui, State of Panama, the "Ramas" belong in Nicaragua at about the spot where the name is repeated. The "Blancos," so called from Pico Blanco, a mountain in their country (Talamanca), consist of three tribes scattered over southeastern Costa Rica. The two tribes placed on the Pacific coast have no existence, but south of where they are located by Mr. Bancroft, there are two semi-civilized tribes, the Terrabas and the Borucas (or Brunkas).

The Guatusos are implacably hostile to civilized men, and are nearly unknown. Popular report makes them partially white, and they have been said to be descended from English buccaneers. It is not impossible that they may have a slight admixture of Spanish blood, derived from the inhabitants of the town of Esparza, who were once driven from their homes by the English. Even this, however, is doubtful, and the most reliable and cautious observers who have penetrated the country or who have seen the few captives, taken out from time to time, agree that they are pure Indians in every respect.

The Blancos, as they are called by the Spaniards, belong to three distinct tribes, divided both geographically and by their languages. They are the Bri-bris, inhabiting nearly all of the watershed of the Tiliri or Sicsola River, the Cabecars, living on the Coen River, and scattered over the region from that point to the frontiers of civilization in Costa Rica, and the Tiribis, living to the southeast of the Bri-bris, on the Tilorio River. The west coast Indians are the Terrabas, an offshoot of the Tiribis, and who still retain a tradition of their emigration from the old home of their tribe to the more hospitable plains of Terraba, and the Borucas, who occupy a simple village, and who seem to be the remains of the original population of this region. These west coast Indians are partially civilized, live under the municipal and ecclesiastical control of a missionary priest, and nearly all speak Spanish. Their languages are being rapidly corrupted by Spanish, and are practically undergoing the process of replacement. Some of the Borucas have already forgotton how to count in their own language, and use only the Spanish numerals.

On the other hand, the people of the Atlantic slope, protected by their nearly impenetrable country, and their active hostility to the Spanish race, have retained their languages in much greater purity, and their customs almost unaltered from the times of their ancestors. Only since the beginning of Mr. Gabb's exploration has the government of Costa Rica obtained a political foothold in the country. The hostility against the Spaniards does not extend to the other white races. English speaking people have been trading with them for about half a century, have always treated them fairly, and are respected. A red beard is the best passport in the country. The most influential man among them is Mr. John Lyon, a Baltimorean, who has been living among them as a trader for the last eighteen years, and is more respected and looked up to than the native chiefs. He is the only white man who has ever established himself in the country, and the exploration owes its success to his active co-operation and sympathy.

The physical characters of the Indians are a short stature, rather thick set. The average height of the men is about 5 feet 4 inches, that of the women a couple of inches less. Tall men are extremely rare, and there is probably not a person in the country over 5 feet 10 inches in height. The hair of the head is coarse, black, and abundant, while it is almost entirely absent on all other parts of the person. Men and women alike are accustomed to carrying heavy loads resting on the back and suspended from the forehead by a strip of bark cloth. In this way they carry with ease from 50 to 75 pounds an entire day, and some have been known to carry 5 arrobas (125 pounds) ten or a dozen miles in a day over rough mountain trails.

Their dress is very simple. The men wear only a breech cloth, a strip of cloth, a foot wide, and seven or eight feet long, wound around the loins. The women wear a petticoat made of a piece of cloth wound round the hips, reaching from the waist to the knees and suspended by a belt. Some of the latter wear an extremely short chemise or jacket, more for ornament than for any use that it serves in covering the person. The men, especially those who have been out of their country, are gradually adopting trowsers or shirts, although the two garments rarely go together. The women braid their hair, parting it in the middle, and exhibit considerable taste in its arrangement. Formerly, the men wore their hair very long, gathered into a queue, wound tightly with cloth, and rolled into a flat mass at the back of the head. Others disposed of it in two braids hanging down the back like the Spanish American women. Now, however, most of them wear it cut rather short.

The men often decorate their heads with a tiara of feathers, and both sexes paint their faces in simple patterns on the cheeks, and wear necklaces. Of the latter, the women wear glass beads, while the men use teeth of animals, principally the canine teeth of tigers.

Mr. Gabb stated that he had submitted to the American Philosophical Society a detailed report of his observations of the Costa Rica Indians, with vocabularies of their several languages.

Compressed Peat.—Mr. Roberts called attention to a piece of artificially compressed New Jersey peat, prepared at the People's Iron Works, Philadelphia, by Mr. John Cooper.

The peat in a dry brown powder was fed into a cylinder and subjected to pressure by means of a drop hammer weighing 1500 pounds, falling a distance of 11 inches. The result was a compact mass of a black color, having a conchoidal fracture, and the lustre of bituminous coal.

July 27.

The President, Dr. Ruschenberger, in the chair.

Thirteen members present.

The following resolution was unanimously adopted:—

Resolved, That the Academy of Natural Sciences of Philadelphia cordially invite the American Association for the Advancement of Science to meet in Philadelphia in 1876.

Geo. Milliken, Jas. B. England, and Howard A. Kelly were elected members.

Papers entitled "Report on the Reptiles brought by Prof. James Orton from the Middle and Upper Amazon and Western Peru," by E. D. Cope; and "Note on the Icthyology of Lake Titicaca," by E. D. Cope, were ordered to be published in the Journal.

The Committee to which they had been referred recommended the following papers to be published.

DESCRIPTIONS OF NEW SPECIES OF AMERICAN LAND AND FRESH-WATER SHELLS.

BY JAMES LEWIS, M.D.

In my paper on the Land Shells of East Tennessee, published in the Amer. Journ. Conch. vi., 188, may be found some remarks upon certain shells treated on page 191 as a large variety of *Helix Sayii.* The shells upon which the remarks here referred to were based, were mutilated specimens, in which some of the characteristics of the species they represented were not clearly attested. Since the publication of the above-mentioned paper additional specimens have been secured, which leave nothing to be inferred as to the true character of the species which is now unhesitatingly presented as new.

Mesodon [Helix] Chilhoweënsis, Lewis.

Shell of large size, umbilicated, convex-depressed; epidermis, pale russet, scarcely paler below; *whorls six to seven* with numerous and somewhat coarse striæ; suture well impressed; peristome white, *well developed* and *widely reflected*, with a *faint rudimentary tooth* indicated near the umbilical region; *parietal wall without any indication of a tooth;* in other particulars the shell may be compared with the species hitherto known as Helix Sayii.

Chilhowee Mountain, East Tennessee, 1869.

Tusquita Bald Mountain (6600 feet elevation), East Tennessee. 1873.

The following are the dimensions of two specimens from the last-named station.

1st. Greatest diameter 1.65 inches = 42 mm. Least diameter 1.32 inches = 33.8 mm. Elevation (parallel to axis) 1.03 inches = 26.3.

2d. Greatest diameter 1.57 inches = 40.9 mm. Least diameter 1.28 inches = 32.7. Elevation 0.94 inches = 23.8 mm. [See Plate 12, figures 5, 6, 7, Amer. Journ. Conch. vi.]

Remarks.—This species will be found uniformly to differ from H. Sayii (a large variety of which it was supposed to be), by having *one more whorl*, a more *broadly reflected lip*, the extremely rudimentary character of the tooth when present on the lip, and by the entire suppression of the parietal tooth, without reference to the larger size of the shell. The species seems to be confined to high elevations on the mountains in east Tennessee and western North Carolina. I am indebted to Miss A. E. Law for all the specimens of this species I have seen.

Zonites acerra, Lewis.

In the paper quoted above, on page 190, mention is made of a shell supposed to be a variety of *Zonites ligerus* of W. G. Binney.[1] The shells when first brought to notice were supposed to be undescribed, but having characters which belong equally to *demissus* and *ligerus* (Binney) it was treated as a variety of *ligerus*, though the name *acerra* was suggested as applicable if new.

I am induced by a careful study of this form to regard it as having quite as valid a claim to be regarded a distinct species as *demissus* has, it being different from that species in several im portant particulars which, so far as I have traced them, seem to be constant. The notes and figures given, relative to this species, render a formal description of the species unnecessary.

The shell has a cubic capacity more than four times that of *demissus*, being less pale, usually more translucent, and the opaque portions have a decided Canary-yellow tint.

This shell is found in the elevated lands in east Tennessee and western North Carolina, and no doubt has been circulated as *demissus*.

Among the numerous land shells collected by Miss Law, in Knox and Monroe Counties, Tennessee, I found a few specimens of a Zonites very like Anthony's *cerinoidea* with this difference—the shells have two internal lamellar teeth, in some cases arising *obliquely* within the aperture and *pointing outwardly*, differing somewhat in form from the teeth of *gularis*. The question arises, is *cerinoidea* dimorphic as to the presence or absence of the internal teeth? I have numerous examples showing that the internal teeth of *gularis* are by no means constant. If the shells I here compare to *cerinoidea* are really a variety of that species, they may be

[1] I speak of "*Zonites ligerus* of W. G. Binney," because I am aware that there are traditions respecting the species now generally accepted as *ligerus* and *intertextus*, which call for a different nomenclature. The shells now known as *intertextus* are the traditional "*Helix ligera*" of Say; the tradition undoubtedly having its origin with Mr. Say, who surely ought to have the credit of knowing his own species. This understanding of the matter makes it quite easy also to recognize the claims of Mr. Lee to the species he described as *Helix Wardiana*.

distinguished as var. *cuspidata*. If, however, they should finally be considered distinct, the name may be retained as characterizing the species.

Vitrina latissima, Lewis, Plate 23, fig. 7.

Shell very much depressed, thin, fragile, translucent, polished; whorls three, very rapidly expanded, with the incrimental lines quite conspicuous and crossed by a few microscopic, impressed, revolving lines; aperture nearly equal to half the area of the base of the shell, very oblique, unsymmetrically-ovate; peristome thin and acute, the columellar origin arising from the axis of the shell; axis imperforate; color of the shell amber-brown.

Transverse diameter 0.68 inches = 17.3 mm. Shorter diameter .47 inches = 11.9 mm. Elevation .27 inches = 7.1 mm.

Tusquita Bald Mountain, at an elevation of 6600 feet. Miss A. E. Law.

A single specimen of this interesting species is all that is at present known. It is remarkable for the entire absence of elevation of the apical whorl above the surrounding whorls, and for its generally depressed and laterally expanded form. The color of the shell is very like that usually exhibited by translucent specimens of Helix [Triodopsis] palliata. The form of the shell forcibly reminds one of the marine shells usually designated *Sigaretus perspectivus*. It will probably be found on several of the mountain peaks of east Tennessee at high elevations.

Melantho obesus, Lewis, MSS., Plate 23, figs. 5, 6.

W. G. Binney, in "Land and Fresh-water Shells of North America," Smithsonian Miscellaneous Collections, No. 144, page 47, fig. 95. No description.

Shell ventricose and disposed to be gibbous; whorls, 6 to 7, rounded, the last dilated; suture well defined and deeply impressed; apex only moderately elevated; epidermis smooth and olivaceous; lines indicating well-defined periods of growth strongly marked and black; surface of the shell traversed with numerous impressed revolving lines; in some localities the revolving lines are mingled with narrow, interrupted, rufous tracings that impart a ferruginous tint to the epidermis; opercle ovate gibbous; substance of the shell only moderately thick, with a tendency in favorable localities to form callosities on the parietal portion of the posterior angle of the aperture; aperture ample and tends to assume a subquadrate form.

Length 1.33 inches = 34 mm. Greatest width 0.95 inches = 24 mm. These dimensions are subject to variation of an extreme character.

Ohio Canal, Columbus, Ohio. H. M. Moores. (Fig. 5.)

Michigan. O. M. Dorman. (Fig. 6.)

In treating Melantho, there seems to have been numerous instances in which species have been misunderstood. *M. obesus* has been confounded with shells occurring in New York with which apparently it has only very remote relations.

In my most recent examinations of *Melantho*, as it occurs in a limited portion of the Erie Canal, near Mohawk, N. Y., I detect three species associated, each constant in its characters without manifesting any tendency to hybridism. A fourth species may possibly be inferred from a division of the various forms I have hitherto regarded as varieties of *integer*.

To make this clear to the reader, I have thought proper to offer a series of figures illustrating the characteristics by which I have made a division.

The prevailing form is illustrated by Fig. 1 of this series. It represents a shell, the whorls of which are very regularly rounded without any tendency to assume gibbous forms. The opercle of the adult shells of this form is very transverse and narrow, resembling that of the typical *ponderosus* of the Ohio River. The texture of the shell is less solid than the gibbous forms exhibit, and the epidermis is much paler. The form of *Melantho* is here illustrated by a specimen more *slender* in its proportion than a typical shell should be.

The gibbous forms, as may be inferred from what has been written above, are more solid in their texture and have a darker epidermis. They are usually also more regularly *smooth*, though gibbous. I have selected three examples as illustrations of the features this form of *Melantho* displays. Fig. 2 may be regarded as approximating the least gibbous phase, and would probably be regarded as one of the *shouldered* specimens of which DeKay wrote. Fig. 3 is a form which W. G. Binney confounds with *obesus*, from which it is sufficiently distinct not to require further notice at this time. Fig. 4 is an extreme form in which the aberrant tendencies of this race of mollusks has been exaggerated by abnormal conditions. These and many other forms in my collection, all part of one series, go far to show that it is unsafe to attempt to decide the limits of species from a few specimens.

FASTI ORNITHOLOGIÆ REDIVIVI.—NO. I. BARTRAM'S 'TRAVELS.'

BY ELLIOTT COUES.

"Come square me this by points of compass—apply the rule of three."

WILLIAM BARTRAM, naturalist, son of John Bartram, botanist, travelled extensively in the Carolinas, Georgia, and Florida, during the latter part of the XVIIIth century, and wrote and caused to be printed a book in which his journeys were traced, and his observations recorded. Which book is entitled as follows, to wit:

"Travels | through | North & South Carolina, | Georgia, | East & West Florida, | the Cherokee Country, the extensive | Territories of the Muscogulges, | or Creek Confederacy, and the | Country of the Chactaws; | containing | an account of the soil and natural | productions of those regions, toge- | ther with observations on the | manners of the Indians. | Embellished with copper-plates. | —— | By William Bartram. | Philadelphia: | printed by James & Johnson, | M,DCC,XCI."—1 vol., 8vo., 1 p. l., pp. i–xxiv, 1–522, pll.

Another edition of which work was issued at Dublin, 1793, being a reprint, E. and O.E.; and further proof of the appreciation of the author's labors was given in the translation of the work into German, and its publication in that language at Berlin, in 1793, as the xth vol. of the Magasin von merkwürdigen neuen Reisebeschreibungen, &c.

Bartram was a naturalist, in the broadest and best sense of the term, whose acquirements in that line were fairly abreast of the times in which he lived, and whose example might be followed with profit if not with pleasure also. He was a traveller of the energy and perseverance that most successful explorers possess. He was a man of unimpeachable veracity, scrupulously exact in every circumstance of detail. He was a thoughtful critic of nature for the love of it; and that he was a judge of human nature is attested by his observations on the Indians: witness his graphic account of the way the Indian maidens (?) used to steal their lovers' rum, under pretence of taking a drink, to peddle it out to these untutored sons of the forest at a premium, when the supply ran low. To his other accomplishments he added that of humble devout Christianity, which was a frequent element in the contemplation of Nature, among thoughtful and sincere men, before she had been much subjected to the scalpel and the microscope—those mighty props of the theory of evolution, which now threatens a revolution in revelation.

The work reflects the man; but upon its general merits, or those of its author, there is no excuse for dwelling. The point that chiefly concerns us at present is, that Bartram, being a naturalist, was necessarily part ornithologist. In point of fact, his love of birds, it is evident in his writings, was second only to that love of plants which was his by right of heritage from the botanist, his father; and, as another matter of fact, his book is discontinuously ornithological throughout.

The book would be called rare by no bibliographer, but neither is it very common now-a-days. It belongs to that large semi-scarce class, which every one interested in the subjects treated knows of, but which most persons quote, upon occasion, at second hand, until, grown wiser by experience in blundering, they feel the force of the scholar's maxim, "always verify quotations!"

The uncommonness, then, of the book has doubtless had some influence upon its author's rather depauperate ornithological laurels. Then again, some of his good seed (as we shall see in the sequel) fell where the fowls (one in particular that might be mentioned) came and ate it. Once more, and worst of all, there hangs about Bartram the unsavory suspicion of a dreadful crime—for the guilt of which some better ornithologists than Linnæus have been sent to unquotable Coventry—I mean polynomialism. So it falls out, that Bartram, *quâ* ornithologist, has not been appreciated.

But the count against him for nearly a century is not a true bill; the verdict must be, if not reversed, radically modified. In brushing some of the dust off the volume of travels, as far as ornithology is concerned, I shall take occasion to prove that according to the articles of nomenclatural war, the customs and precedents in such cases established, and the Rules of the British Association, Bartram has not received his due. That is to say, if we owe him anything, we have not paid him enough; if we owe him nothing, we have, nevertheless, given him some tribute. For we have let him doze by the hearth-stone of nomenclature, in his polynomial undress, and wakened him up occasionally when we wanted some little binomial favor, like *Vultur atratus*, or *Corvus floridanus* or *C. carnivorus*, for example. This is justice, neither to him nor ourselves. The greatest stickler of all for the conventionalities of nomenclature will admit, that if any of Bartram's names are available, so are all of his identifiable binomials. No point is clearer than this; and equally indisputable are the following propositions:—

1. Bartram wrote subsequent to 1766.

2. He was effectually, systematically, and on principle binomial, occasionally lapsing. But if his exceptional slips are to count against him, then not a few great modern ornithologists must also be ruled out; among whom may be instanced Schlegel, Bonaparte, Sundevall, and others, in whose writings are found trinomial names, the three terms of which succeed each other consecutively without intervention of any kind of punctuation to bring about even a semblance of binomiality.

3. Several of Bartram's names are in current usage, unchallenged, and many others are among ordinary synonymatic quotations.

4. In 1791, Bartram published a *descriptive* catalogue of the, to him then known, Birds of the Eastern United States, 215 in number, in which list are introduced various species for the first time named binomially; some of which names are already in use, as just said, but more of which have been ignored, or only used in attribution to later writers, especially Wilson.

It is not expected to prove Bartram's availability to the satisfaction of everybody; but the fact that he must be either ruled out altogether, or fully accepted, is demonstrably indisputable. Upon this premise, we set ourselves to enquire into the nature of his claims upon our recognition.

At various pages of his work, Bartram describes, at length and with particularity, several species of birds, to which he applies names, such as *Vultur atratus*, *Meleagris americana*, and *Tantalus pictus*. These accounts leave no question open but that touching the author's method of nomenclature.

But the main ornithological interest of the work centres in the List Bartram gives. If Wilson was the father of American Ornithology, as he has been styled, Bartram, back to whom the pedigree of many names is traceable, was certainly the grandfather of that vigorous offspring. His statement of United States' birds is one of the earliest of those which are of any special account, and which treat exclusively of this subject, while its extent and general pertinence entitle the author to rank among the fathers. His practical availability, however, for nomenclatural purposes, is another question, to be decided mainly upon our interpretation of his summary of 215 birds as "a mere list of names," or as a *bonâ fide* descriptive catalogue.

What is a description? It is any intelligibly indicative phrase. It may be extended to a treatise, or be comprised in a single word. Diagnosis is condensed description, to exclusion of non-essential particulars. Length of terms is obviously no criterion. Definition, diagnosis, description, are practically convertible terms. No one can fail to perceive that Bartram has treated every one of his species with description, diagnosis, or definition, and left no doubt of his meaning in the majority of cases. Even in the cases of his shortest definitions, it is only by shutting our eyes, with a tight squeeze too, that we can fail to perceive that names such as Bartram uses, are, like names in general, originally, the essence of description. And in any event the "mere name" theory can only be urged as an objection to a part of Bartram's species, some of them being described at length, to the letter as well as in the spirit of the law. No one can claim that, *e.g.*, Bartram's nos. 105, or 274, or 181, are not "described," or that they are precluded from recognition, because they occur in an article where some other species may not be described. Nor is there any essential difference between the mode of treatment of these species, and of no. 93 for instance, where Bartram says "Fringilla fusca, the large brown white throat sparrow." Nor, to take an extreme case, as no. 100, has any one any doubt what Bartram meant in saying "Sturnus stercorarius, the cowpen bird?"

For those who cling to the "mere name" theory, there is an argument in reserve. As Dr. Sclater has well observed, in treating of zoogeographical areas, the distribution of a species is as much one of its attributes, as any matter of form, size, or other physical property. Description, of course, may be based upon any quality that pertains to the object. Now Bartram prefaces his list with a set of formularized descriptions of geographical distribution, migration, or nidification, which he has caused to apply severally and individually to every one of his species,[1] by the use of certain perfectly well understood typography. The fact, therefore, is

[1] Excepting no. 161, where no asterisk appears, by evident oversight or typographical error.

established, that Bartram's birds are *described* as well as named. The accuracy and pertinence or the reverse, of his descriptions, is immaterial to the point at issue; his species are simply to be identified, upon the principles applied and by the means employed, in all other cases, by ornithological experts.

Bartram's method of nomenclature only remains for discussion; and in this matter much might be said *pro* and *con*. The gist of the case is, as already said, that he is systematically binomial on principle, with occasional lapses, which, however, do not invalidate his system any more than the similar deviations from strict binomiality in the above-mentioned cases of Schlegel or Bonaparte. It is not to the point to argue a difference in intent or meaning as *e. g.* between Bonaparte and Schlegel's *Loxia curvirostra rubrifasciata*, and Bartram's *Loxia rostro forficato;* for in either case the trinomial result is the same. In fact, in such cases, it may be replied with greater force, that through ignorance, oversight, or for other reason Bartram simply failed to give a name at all; his Loxia rostro forficato, for instance, being described, but not named. This point is at any rate as well taken as the objections to Bartram's binomiality can be. As to the form of his nomenclatural and diagnostic phrases, it may be observed, they are in close accord with the custom of the day. "Parus cedrus, uropygio flavo, the yellow rump" (no. 115) is thoroughly *en règle*, and to claim that "P. aureus vertice rubro, the yellow red pole" (no. 118) is any different, for want of the comma, would be to hang a man's reputation on a punctuation point—surely the disingenuous quibble of a pleader, in a great strait.

It is an evident corollary of what has gone before, that Bartram is entitled to unreserved recognition among ornithologists. Such of his species as are binomially named and fully identified must take their rightful place in the curriculum of synonymatic quotation; and those names which are found to possess the quality of priority must be adopted. Bartram's names are not simply literary curiosities, nor is their examination a mere matter of bibliomania. For the nomenclature of some fifteen or twenty of our commonest birds hangs upon the acceptance or rejection of this author. The case is submitted to the candid consideration of ornithologists.

In order to the most complete exposition of the case, and that ornithologists may the more readily be enabled to judge for themselves whether the present advocacy is in a good or bad cause, Bartram's List is here reproduced, *verb. lit. punct.*, saving only omission of certain superfluous subheads of his, and insertion of numbers whereby cross-reference with the commentary which accompanies is facilitated. To ensure accuracy, the press-proofs are corrected from the original, not, as usual, from the MS. copy.

[Bartram's Descriptive Catalogue of the Birds of the Eastern United States. (Trav. N. & S. Car. &c., 1791,[1] pp. 288–296.[2])]

[p. 288.]

BEING willing to contribute my mite towards illustrating the subject of the peregrination of the tribes of birds of N. America, I shall subjoin a nomenclature of the birds of passage, agreeable to my observation, when on my travels from New-England to New-Orleans, on the Missiippi, and point of Florida.

LAND birds which are seen in Pennsylvania, Maryland, Virginia, N. and S. Carolina, Georgia and Florida, from the sea coast Westward, to the Apalachian mountains, viz.

* THESE arrive in Pennsylvania in the spring season from the South, which after building nests, and rearing their young, return again southerly in the autumn.

[p. 289.]

† THESE arrive in Pennsylvania in the autumn, from the North, where they continue during the winter, and return again the spring following, I suppose to breed and rear their young; and these kinds continue their journies as far South as Carolina and Florida.

‡ THESE arrive in the spring in Carolina and Florida from the south, breed and rear their young, and return south again at the approach of winter, but never reach Pennsylvania or the Northern States.

‖ THESE are natives of Carolina and Florida, where they breed and continue the year round.

¶ These breed and continue the year round in Pennsylvania.

[1] The Dublin edition, 1793, contains numerous mere typographical differences, for better or worse.

[2] The pagination of the work is erroneous, in just this place, the numbering of pp. 289, 290, being repeated, and p. 294 being numbered "492." Curious trap for unwary citators at second hand!

1. † Strix arcticus, capite levi corpore toto niveo, the great white owl.
2 ¶ Strix pythaules, capite aurito, corpore rufo, the great horned owl.
3. † Strix maximus, capite aurito, corpore niveo, the great horned white owl.
4. ¶ Strix acclamator, capite levi, corpore grisco, the whooting owl.
5. † Strix peregrinator, capite aurito, corpore versicolore, the sharp winged owl.
6. ¶ Strix assio, capite aurito, corpore ferruginio, the little screech owl.
7. ‖ Vultur aura, the turkey-buzzard.
8. ‖ Vultur sacra, the white tailed vulture.
9. ‖ Vultur atratus, black vulture, or carrion crow.

[p. 290.]

10. ¶ Falco regalis, the great grey eagle.
11. ¶ F. leucocephalus, the bald eagle.
12. * F. piscatorius, the fishing eagle.
13. ¶ F. Aquilinus, cauda ferrug. great eagle hawk.

Commentary on the foregoing List.

1. NYCTEA NIVEA.

2. BUBO VIRGINIANUS.

3. BUBO VIRGINIANUS var. ARCTICUS, Cassin, ex *Strix arctica*, Sw. & Rich., F. B. A. ii. 1831, 86, pl. 30. Bartram's name has priority for this white variety of the *B. virginianus*, but the term *maximus* would cause confusion with the European *Bubo*, besides being antedated in the genus.

4. SYRNIUM NEBULOSUM. — *Strix nebulosa*, Forst., Phil. Trans. lxii. 1772, 386, 424.

5. Undetermined ;—one of the *Oti*, whether *wilsonianus* or *brachyotus* is uncertain.

6. SCOPS ASIO.

7. CATHARTES AURA.

8. Undetermined. This is Bartram's particular puzzle; it is elaborately, but not recognizably, described at p. 150. *cf.* especially Cass., B. Cal. and Tex. i. 1853, p. 59, and Allen, Bull. Mus. Comp. Zool. ii. 1871, pp. 313 et seqq.

9. CATHARTES ATRATUS (Bartr.)! The name has already been very generally adopted from Bartram, who fully describes the bird, with accuracy, at p. 152.

10, 11. HALIAËTUS LEUCOCEPHALUS, juv. et ad. Description, p. 3.

12. PANDION HALIAËTUS (*carolinensis* auct.). Description, p. 3.

13. BUTEO BOREALIS.

14. ¶ F. gallinarius, the hen hawk.
15. ¶ F. pullarius, the chicken hawk.
16. * F. columbarius, the pidgeon hawk.
17. ¶ F. niger, the black hawk.
18. * F. ranivorus, the marsh hawk.
19. * F. sparverius, the least hawk or sparrow hawk.
(*a*)
20. || Falco furcatus, the forked tail hawk, or kite.
21. || F. glaucus, the sharp winged hawk, of a pale sky-blue colour, the tip of the wings black.
22. || F. subcerulius, the sharp winged hawk, of a dark or dusky blue colour.
23. || Psitticus Caroliniensis, the parrot of Carolina, or parrakeet.

14, 15. Neither determinable. May be young of No. 13, or some other *Buteo*, or *Accipiter cooperi.*

16. Falco columbarius.

17. Archibuteo sanctijohannis. (*A. lagopus*, auct. Amer.)

18. Circus hudsonius.

19. Falco sparverius.

20. Elanoides forficatus; *F. furcatus*, Linn., 1766; *F. forficatus*, Linn., 1758; *Nauclerus furcatus*, Vig.; *Nauclerus forficatus*, Ridgw., 1874.

21. Elanus GLAUCUS (Bartr.)! The description, the ascribed habitat, together with the note of form and habit respecting this species and Nos. 20, 22, and their allocation together under *Milvus*, leave no doubt whatever of Bartram's meaning. This then is the bird commonly known as *Elanus leucurus*, after Temminck, over which name *glaucus* has tenable priority.

22. Ictinia SUBCÆRULEA (Bartr.)! The same complete identification obtains in this case as in that of No. 21. The nomenclature is strictly binomial, the description accurate as far as it goes, the habitat correctly given, and the additional evidence irrefragable. The bird is that subsequently described by Wilson as *Falco mississippiensis*, and commonly known as *Ictinia mississippiensis*, which specific name must give way to Bartram's.

23. Conurus carolinensis. Further account, p. 301.

[(*a*) Bartram ranges the next three species under a separate subhead, "Milvus. Kite Hawk." And says in a footnote: "Kite Hawks. These are characterised by having long sharp pointed wings, being of swift flight, sailing without flapping their wings, lean light bodies, and feeding out of their claws on the wing, as they gently sail round and round"—a very good diagnosis of a milvine bird.]

24. * Corvus carnivorus, the raven.
25. || C. maritimus, the great sea-side crow, or rook.
26. ¶ C. frugivorus, the common crow.
27. ¶ C. cristatus, s. pica glandaria, the blue jay.
28. ¶ C. Floridanus, pica glandaria minor, the little jay of Florida.
29. ¶ Gracula quiscula, the purple jackdaw of the sea coast.

[p. 289 *bis.*]

30. * Gracula purpurea, the lesser purple jackdaw, or crow blackbird.
31. * Cuculus Caroliniensis, the cuckoo of Carolina.

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24. CORVUS CARNIVORUS, Bartr.! This name was adopted for the American raven in 1858, by Prof. Baird, whose example has been followed, without question or hesitation, by all subsequent American writers who separate it from *C. corax*. Yet it is a bare name, unaccompanied by even the semblance of a description, excepting that implied in the use of the asterisk.

25. CORVUS MARITIMUS, Bartr.!—*C. ossifragus*, Wils. This is evidently the fish crow, although it must be conceded that the expression 'great' is inapplicable. In marking it ||, Bartram correctly indicates the restriction of its habitat in comparison with that of the Raven or of the Common Crow.

26. CORVUS FRUGIVORUS, Bartr.!—*C. americanus*, Aud. Here is a case exactly parallel with that of No. 24. "*C. carnivorus*, the raven;" "*C. frugivorus*, the common crow." To be consistent, authors must either cease to say *Corvus carnivorus*, or else say *Corvus frugivorus* too. Consistency is a jewel. The simple fact is appearing in stronger light as we proceed, that we must either take Bartram *en bloc*, or give him up altogether.

27. CYANURUS CRISTATUS.

28. CYANOCITTA FLORIDANA (Bartr.)! Name already in universal employ.

29. QUISCALUS MAJOR, Vieill.—The expression "purple jackdaw of the seacoast" is perfectly diagnostic, the species being thoroughly maritime, and always called jackdaw in the countries it inhabits. To those to whom such alliterative names as *Sialia sialis*, *Cupidonia cupido*, &c., are unobjectionable, I suggest the propriety of calling this species, *Quiscalus quiscula* (Bartr.)!

30. QUISCALUS PURPUREUS (Bartr.)!—*Q. versicolor*, Vieill. Bartram's name has been frequently employed, though of late, for a time, generally superseded by Vieillot's of subsequent date, until restored by Mr. Cassin.

31. COCCYZUS AMERICANUS. There is really nothing to show which species Bartram meant by this name, but this is obviously the origin of Wilson's name, for the yellow-billed Cuckoo.

32. || Picus principalis, the greatest crested woodpecker, having a white back.
33. * P. pileatus, the great red crested black woodpecker.
34. * P. erythroeephalus, red headed woodpecker.
35. * P. auratus, the gold winged woodpecker.
36. ¶ P. Carolinus, the red bellied woodpecker.
37. ¶ P. pubescens, the least spotted woodpecker.
38. ¶ P. villosus, the hairy, speckled and crested woodpecker.
39. ¶ P. varius, yellow bellied woodpecker.
40. ¶ Sitta Europea, gray black capped nuthatch.
41. † Sitta varia, ventre rubro, the black capped, red bellied nuthatch.
42. † Certhia rufa, little brown variegated creeper.
43. * C. pinus, the pine creeper.
44. * C. picta, blue and white striped or pied creeper.
45. * Alcedo alcyon, the great crested king-fisher.
46. * Trochilus colubris, the humming bird.
47. * Lanius griseus, the little grey butcher-bird of Pennsylvania.
48. * L. garrulus, the little black capped butcher-bird of Florida.

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32. Campephilus principalis.
33. Hylotomus pileatus.
34. Melanerpes erythrocephalus.
35. Colaptes auratus.
36. Centurus carolinus.
37. Picus pubescens.
38. Picus villosus.
39. Sphyropicus varius.

Bartram has all his Woodpeckers right, under prior and tenable names; and his list includes every one of the Eastern United States, excepting *P. querulus*. No. 32, for "white back" *read* "white beak."

40. Sitta carolinensis.

41. Sitta canadensis. Here is obviously the origin of Wilson's term, *S. varia*.

42. Certhia RUFA (Bartr.)! Nomenclature binomial, and description diagnostic; the name should stand with those who separate the bird from the European.

43. Dendrœca PINUS (Bartr.)! The name is universally attributed to Wilson, but we here see its original source.

44. Mniotilta varia. "Blue and white" is an evident slip for "black and white." Here and in other cases it is evident that Bartram drew up his list from memory.

45. Ceryle alcyon.
46. Trochilus colubris.
47. Collurio borealis?
48. Collurio ludovicianus.

49. * L. tyrannus, the king bird.
50. * Muscitapa nunciola, the pewit, or black cap flycatcher.
51. * M. cristata, the great crested yellow bellied flycatcher.
52. * M. rapax, the lesser pewit, or brown and greenish flycatcher.
53. * M. subviridis, the little olive cold. flycatcher.

[p. 290 *bis.*]

54. * Muscicapa cantatrix, the little domestic flycatcher or green wren.
55. * M. sylvicola, the little red eye'd flycatcher.
56. * Columba Caroliniensis, the turtle dove.
57. || C. passerina, the ground dove.
58. † C. migratoria, the pigeon of passage or wild pigeon.
59. * Alauda magna, the great meadow lark.
60. † A, campestris, gutture flavo, the sky lark.
61. † A. migratoria, corpore toto ferrugineo, the little brown lark.
62. ¶ Turdus migratorius, the fieldfare or robin redbreast.
63. * T. rufus, the great, or fox coloured thrush.
64. * T. polyglottos, the mocking bird.

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49. TYRANNUS CAROLINENSIS.

50. SAYORNIS FUSCUS. *Muscicapa nunciola* is Bartram's, not, originally, Wilson's.

51. MYIARCHUS CRINITUS.

52. CONTOPUS VIRENS. *Muscicapa rapax* is Bartramian, not originally Wilsonian.

53. EMPIDONAX ACADICUS. *M. subviridis*, Bartr., is quoted in Jardine's edition of Wilson for the *M. acadicus* of authors, doubtless correctly, because it is the only *Empidonax* known to breed in Pennsylvania, as indicated by Bartram.

54. VIREO NOVEBORACENSIS. *Cantatrix*, Bartr., *olim ;* Wils., *nuper*.

55. VIREO OLIVACEUS. Wilson transferred the name *M. sylvicola* to *V. flavifrons*, Vieill.

56. ZENAIDURA CAROLINENSIS.

57. CHAMÆPELIA PASSERINA.

58. ECTOPISTES MIGRATORIA. Full account, p. 469.

59. STURNELLA MAGNA.

60. EREMOPHILA ALPESTRIS.

61. ANTHUS LUDOVICIANUS.

62. TURDUS MIGRATORIUS.

63. HARPORHYNCHUS RUFUS.

64. MIMUS POLYGLOTTUS.

65. * T. melodes, the wood thrush.
66. * T. minimus, vertice aurio, the least golden crown thrush.
67. * Oriolus Baltimore, Baltimore bird or hang nest.
68. * O. spurius, the goldfinch or icterus minor.
69. * Merula flammula, sand-hill redbird of Carolina.
70. * M. Marilandica, the summer red bird.
71. * Garrulus australis, the yellow breasted chat.
72. * Lucar lividus, apice nigra, the cat bird, or chicken bird.
73. ¶ Ampelis garrulus, crown bird, or cedar bird.
74. ¶ Meleagris Americanus, the wild turkey.
75. ¶ Tetrao lagopus, the mountain cock, or grous.

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65. Turdus mustelinus. Another case of Bartramian origin of an ascribed Wilsonianism.

66. Seiurus auricapillus.

67. Icterus baltimore.

68. Icterus spurius.

69. Not recognized. (Pyranga rubra ?)

70. Pyranga æstiva.

71. Icteria virens (L., 1758).—*I. viridis*, Auct. See p. 302, for further account, where the bird is called *Motacilla trochilus*.

72. LUCAR carolinensis ! That the diagnostic expression "apice nigra," is a slip for "vertice nigra" is seen on reference to p. 299, where further account of the cat bird is given. Bartram's specific name, commonly ascribed to Wilson, is antedated by the Linnæan ; but his curious generic term is not so easily disposed of. It is exactly coëqual with the subsequent *Felivox* of Bonaparte, and *Galeoscoptes* of Cabanis ; and, for those who place the cat-bird in the same genus with the mocking-birds, will be considered also equivalent to *Mimus*, Boie. What is to be done in this case ? The name is probably meaningless, and in fact, looks like a misprint ; but if all barbarous and meaningless names are to be excluded on these scores, the revolution in nomenclature would be very great. "*Lucar*" is no worse than "*Jotha*," which some years since occasioned the issue between Prof. E. Forbes and Dr. J. E. Gray. *Lucar* is a very nice point as it stands, and as such is commended to the consideration of ornithologists.

73. Ampelis cedrorum. Full account, p. 298.

74. Meleagris AMERICANA Bartr. ! The wild turkey is fully described at pp. 14, 83, at the latter under the name of *M. occidentalis*. Bartram's name is among the current quotations, and I recently adopted it, subspecifically, as the designation of the Eastern United States form, as distinguished from the Mexican, or true *M. gallopavo*, Linn.

75. Undetermined. No *Lagopus* nor true *Tetrao* inhabits Pennsylvania. Can Bartram have intended the *Cupidonia*, which formerly ranged eastward ?

76. ¶ T. tympanus, the pheasant of Pennsylvania.
77. ¶ T. minor, s. coturnix, the quail or partridge.
78. ¶ Loxia cardinalis, the red bird, or Virginia nightingale.
79. † L. rostro forficato, the cross beak.
80. * L. cerulea, the blue cross beak.

[p. 291.]

81. * Emberiza oryzivora, (1) the rice bird.*
82. ‡ E. livida, the blue or slate coloured rice bird.
83. * E. varia, (2) the pied rice bird.
84. ‡ Linaria ciris, the painted finch, or nonpareil.
85. * L. cyanea, the blue linnet.
86. ¶ Carduelus Americanus, the goldfinch.
87. † C. pinus, the lesser goldfinch.
88. † C. pusilus, the least finch.
89. * Fringilla erythrophthalma, the towhe bird.
90. † F. purpurea, the purple finch.
91. † F. canabina, the hemp bird.
92. † F. rufa, the red, or fox-coloured ground or hedge sparrow.

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* (1 2) Are generally supposed to be male and female of the same species (2) or the pied rice bird the male, and (1) or the yellow, the female.

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76. Bonasa umbellus.
77. Ortyx virginiana.
78. Cardinalis virginianus.
79. Loxia americana.
80. Guiraca caerulea.
81. Dolichonyx oryzivora, ♀.
82. Undetermined; nor is it evident why this is interpolated between the two sexes of *Dolichonyx*.
83. Dolichonyx oryzivora, ♂. Extended account given, pp. 296–298.
84. Cyanospiza ciris. Further account, p. 299.
85. Cyanospiza cyanea. Further account at p. 299.
86. Chrysomitris tristis.
87. Chrysomitris PINUS (Bartr.)! Name commonly ascribed to Wilson.
88. Undetermined. (Ægiothus linaria?)
89. Pipilo erythrophthalmus.
90. Carpodacus purpureus.
91. Undetermined.
92. Passerella iliaca.

93. † F. fusca, the large brown white throat sparrow
94. * Passer domesticus, the little house sparrow or chipping bird.
95. * P. palustris, the reed sparrow.
96. * P. agrestis, the little field sparrow.
97. † P. nivalis, the snow bird.
98. * Calandra pratensis, the May bird.
99. * Sternus predatorius, the red winged sterling, or corn thief.
100. * S. stercorarius, the cowpen bird.
101. * Motacilla sialis, the blue bird. (Rebicula Americana, Cat.)
102. * M. fluviatilis, the water wagtail.
103. * M. domestica (regulus rufus) the house wren.
104. ¶ * M. palustris, (reg. minor) the marsh wren.
105. * M. Caroliniana, (reg. magnus) the great wren of Carolina, the body of a dark brown, the throat and breast of a pale clay colour.
106. * Regulus griceus, the little bluish grey wren.
107. † R. cristatus, the golden crown wren.

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93. Zonotrichia albicollis.

94. Spizella DOMESTICA (Bartr.)!—*S. socialis*, Auct. In his Obs. Wils., Bp. speaks of Fringilla domestica, Bart., as the *S. socialis*, but does not adopt it, simply because he referred the bird to *Fringilla*, in which genus there was already a Linnæan *domestica*.

95. Melospiza PALUSTRIS (Bartr.)! The name is commonly attributed to Wilson.

96. Spizella AGRESTIS (Bartr.)!—*S. pusilla*, Auct. The name has already been mentioned in this connection by Bonaparte.

97. Junco hyemalis. The same term, *nivalis*, is used by Wilson.

98. Undetermined.

99. Agelæus phœniceus. Evidently the origin of Wilson's *Sturnus predatorius*.

100. Molothrus ater (Bodd.).—*M. pecoris*, Gm., Auct. So far as I know, Bartram is alone in the use of the specific name *stercorarius*.

101. Sialia sialis (L.).

102. Seiurus noveboracensis.

103. Troglodytes DOMESTICA (Bartr.)!—*Trog. aëdon*, Vieill., Auct. Wilson took his name from Bartram, and Bonaparte recognizes its source.

104. Cistothorus PALUSTRIS (Bartr.)! The name is currently ascribed to Wilson.

105. Thryothorus ludovicianus.

106. Polioptila cærulea.

107. Regulus satrapa.

[p. 292.]

108. † R. cristatus alter vertice rubini coloris, the ruby crown wren. (G. Edwards.)
109. * R. peregrinus, gutture flavo, the olive coloured yellow throated wren.
110. * Ruticilla Americana, the redstart.
111. * Luscinia, s. philomela Americana, the yellow hooded titmouse.
112. * Parus cristatus, bluish grey crested titmouse.
113. ¶ P. Europeus, the black cap titmouse.
114. * P. luteus, the summer yellow bird.
115. * P. cedrus, uropygio flavo, the yellow rump.
116. * P. varius, various coloured little finch creeper.
117. * P. peregrinus, little chocolate breast titmouse.
118. * P. aureus vertice rubro, the yellow red pole.
119. * P. aurio vertice, the golden crown flycatcher.
120. * P. viridis gutture nigro, the green black throated flycatcher.
121. * P. alis aureis, the golden winged flycatcher.
122. * P. aureus alis ceruleis, the blue winged yellow bird.
123. * P. griceus gutture luteo, the yellow throated creeper.
124. * Hirundo pelasgia, cauda aculeata, the house swallow.
125. * H. purpurea, the great purple martin.

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108. Regulus calendula. (Not binomially named.)
109. Geothlypis trichas.
110. Setophaga ruticilla.
111. Undetermined, and not binomially named.
112. Lophophanes bicolor.
113. Parus atricapillus.
114. Dendrœca æstiva.
115. Undetermined. If meant for *Dendrœca coronata*, the asterisk is misplaced.
116. Parula americana.
117. Undetermined. (*Dendrœca castanea?*)
118. Dendrœca palmarum.
119. Undetermined. (*Dendrœca coronata?*)
120. Dendrœca virens.
121. Helminthophaga chrysoptera, but not binomially named.
122. Helminthophaga pinus.
123. Dendrœca dominica.
124. Chætura pelagica (Linn. 1758).
125. Progne purpurea.

126. * H. riparia vertice purpurea, the bank martin.
127. * H. cerdo, the chimney swallow.
128. ‡ Caprimugus lucifugus, the great bat, or chuck wills widow.
129. * C. Americanus, the night hawk or whip poor will.
130. ‖ Grus clamator, vertice papilloso, corpore niveo remigibus nigris, the great whooping crane.

[p. 293.]

131. † G. pratensis, corpore cinereo, vertice papilloso, the great savanna crane.
132. ¶ Ardea herodias, the great bluish grey crested heron.
133. * A. immaculata, the great white river heron.
134. * A. alba minor, the little white heron.
135. ‡ A. purpurea cristata, the little crested purple or blue heron.
136. * A. varra cristata, the grey white crested heron.
137. ‡ A. maculata cristata, the speckled crested heron, or crab-catcher.
138. * A. mugitans, the marsh bitern, or Indian hen.
139. * A. clamator, corpore subceruleo, the quaw bird, or frog-catcher.
140. ‡ A. subfusca stillata, the little brownish spotted bitern.

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126. Cotyle riparia.

127. Chætura pelagica *bis*.

128. Antrostomus carolinensis. Called *C. rufus* at p. 154, where distinguished from the whippoorwill.

129. Antrostomus vociferus, plus Chordeiles popetue, these two species being confounded by Bartram, as by his predecessors. In using the term *americana*, Wilson afterwards restricted it to the *Chordeiles*.

130. Grus americana.

131. Grus canadensis. Bartram's names for the two cranes are among their current synonyms; the birds are well described, as at pp. 201, 220.

132. Ardea herodias.

133. Herodias egretta.

134. Garzetta candidissima. Not binomially named.

135. Florida cærulea. Not binomially named.

136. Undetermined, and not binomially named.

137. Undetermined, and not binomially named.

138. Botaurus MUGITANS (Bartr.)!—*B. lentiginosa*, Mont. An Ardea stellaris *var.* minor, Gm., has been quoted by some for this bird, but no such term occurs in Gmelin, who gives the American bird as β. Botaurus freti hudsoni, after Brisson (p. 636).

139. Nyctiardea grisea (Bodd.).—*N. gardeni*, Auct.

140. Undetermined, and not binomially named.

141. ‡ A. violacca, the crested blue bitern, (called poor Jobe.)
142. * A. viriscens, the green bitern or poke.
143. * A. viriscens minor, the lesser green bitern.
144. * A. parva, the least brown and striped bitern.
145. * Platalea ajaja, the spoonbill, seen as far North as Alatamaha river in Georgia. [*a*]
146. ‡ Tantalus loculator, the wood pelicane.
147. ‡ T. alber, the white Spanish curlew.
148. ‡ T. fuscus, the dusky and white Spanish curlew.
149. ‖ T. pictus, (Ephouskyka Indian) the crying bird, beautifully speckled.
150. ‖ T. Ichthyophagus, the gannet, perhaps little different from the Ibis.
151. ‖ Numenius, alba varia, the white godwit.
152. ¶ N. pectore rufo, the great red breasted godwit

[p. 294, wrongly marked "492."]

153. ¶ N. Americana, the greater godwit.
154. ¶ N. fluvialis, the red shank or pool snipe.
155. ¶ N. magnus rufus, the great sea coast curlew.

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141. Nyctiardea violacea.
142. Butorides virescens.
143 Butorides virescens, *bis*.
144. Ardetta exilis.
145. Platalea ajaja.
146. Tantalus loculator. Full description at p. 149.
147. Ibis alba. Full description at p. 148.
148. Ibis alba, juv. Full description at p. 148.
149. Aramus PICTUS (Bartr.)!—*A. giganteus* (Bp.). The bird is minutely and accurately described at p. 147. There is no question of this bird, and the nomenclature is exclusively binomial. It is the "Ephouskyca" or "Ephouskyka," said to be the Indian term for "crying bird."
150. Tantalus loculator, *bis*. See what Audubon says about the Wood Ibis being called "gannet" in Florida.
151. Undetermined. (*Recurvirostra americana?*)
152. Undetermined.
153. Undetermined.
154. Undetermined. (*Totanus melanoleucus or flavipes?*)
155. Undetermined. (*Numenius longirostris?*)

[*a*] Hence the asterisk is wrongly affixed; it should be ‡.

156. * N. minor campestris, the lesser field curlew.
157. ¶ N. cinereus, the sea side lesser curlew.
158. * Scolopax Americana rufa, great red woodcock.
159. * S. minor arvensis, the meadow snipe.
160. * Tringa rufa, the red cootfooted tring.
161. T. cinerea, gutture albo, the white throated cootfooted tringa.
162. * T. vertice nigro, black cap cootfooted tringa.
163. ¶ T. maculata, the spotted tringa.
164. ¶ T. griceus, the little pond snipe.
165. ¶ T. fusca, the little brown or ash coloured pool snipe.
166. ¶ T. parva, the little trings of the sea shore, called sand birds.
167. * Morinella Americana, the turnstone or dottrill.
168. † Cygnus ferus, the wild swan.
169. † Anser Canadensis, the Canadian goose.
170. † A. aliis ceruliis, the blue winged goose.
171. † A. fuscus maculatus, the laughing goose.
172. † A. branta, corpore albo, remigibus nigris, the white brant goose.
173. † A. branta grisca maculata, the great particoloured brant, or grey goose.

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156. Undetermined.
157. Undetermined. (*Totanus semipalmatus?*)
158. PHILOHELA MINOR. (Not binomially named.)
159. Undetermined.
160. Undetermined. (Certainly no Phalarope.)
161. Undetermined. (Not a Phalarope.)
162. Undetermined. (Not a Phalarope.)
163. TRINGOIDES MACULARIUS.
164. Undetermined.
165. Undetermined.
166. EREUNETES PUSILLUS *plus* TRINGA MINUTILLA.
167. STREPSILAS INTERPRES. Breeding in Penna.! I guess not.
168. CYGNUS AMERICANUS.
169. BRANTA CANADENSIS.
170. ANSER CÆRULESCENS, Linn. Bartram was wiser here than some of his successors have been.
171. ANSER GAMBELI.
172. CHEN HYPERBOREUS.
173. BRANTA BERNICLA.

174. † Anas fera torquata major, caput et collum viridi splendentis, dorsum griseo fuscum, pectore rufescente speculum violacrum, the great wild duck, called duck and mallard.
175. † A. nigra maxima, the great black duck.
176. † A. bucephala, the bull-neck and buffaloe head.
177. † A. subcerulea, the blue bill.
178. † A. leucocephala, the black white faced duck.
179. † A. caudacuta, the sprig tail duck.
180. † A. rustica, the little brown and white duck.

[p. 295.]

181. † A. principalis, maculata, the various coloured duck, his neck and breast as tho' ornamented with chains of beads.
182. † A. minor picta, the little black and white duck called butterback.
183. * Anas sponsa, the summer duck.
184. † A. discors, the blue winged teal.
185. † A. migratoria, the least green winged teal.
186. * A. fistulosa, whistling duck.
187. † Mergus major pectore rufo, great fishing duck
188. †. M. cucullatus, the round crested duck.
189. * Colymbus migratorius, the eel crow.
190. || C. Floridanus, the great black cormorant of Florida, having a red beak.

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174. Anas boschas.
175. Anas obscura ? or Oedemia ?
176. Bucephala claugula.—*B. americana*, Bd.
177. Fuligula marila ? or F. affinis ?
178. Fuligula marila ♀ ? or F. affinis ♀ ?
179. Dafila acuta.
180. Bucephala albeola ♀.
181. Undetermined. (*Chaulelasmus ?*)
182. Bucephala albeola ♂.
183. Aix sponsa.
184. Querquedula discors.
185. Querquedula carolinensis.
186. Undetermined.
187. Mergus serrator.
188. Mergus cucullatus.
189. Undetermined.
190. Graculus FLORIDANUS (Bartr.) ! Same as the species of Audubon, who applied the same name independently. "Red beak" is evidently a confusion in memory, red gular pouch and lores being meant.

191. ‖ C. colubrinus, cauda elongata, the snake bird of Florida.
192. ¶ C. musicus, the great black and white pied diver or loon.
193. † Colymbus arcticus, the great speckled diver.
194. ¶ C. auritus et cornutus, the little eared brown dobekick.
195. ¶ C. minor fuscus, the little crested brown dobekick.
196. ‡ Phaeaton aethereus, the tropic bird.
197. ¶ Larus alber, the great white gull.
198. ¶ L. griceus, the great grey gull.
199. ¶ L. alba minor, the little white river gull.
200. ‖ Onocratalus Americanus, the American sea pelicane.
201. ‖ Petrella pintada, the pintado bird.
202. ¶ Rhynchops niger, the shearwater or razor bill.
203. ‡ Pelicanus aquilus, the frigat or man of war bird.
204. ‡ P. sula, the booby.
205. ‡ Sterna stolida, the sea swallow, or noddy.

[p. 296.]

206. * Charadrus vociferus, the kildea or chattering plover.
207. * C. maculatus, the great field spotted plover.
208. * C. minor, the little sea side ring necked plover.
209. * Hematopus ostrealegus, the will willet or oister catcher.

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191. PLOTUS ANHINGA. Described very fully at p. 132.
192. COLYMBUS ——— ?
193. COLYMBUS ——— ?
194. PODICEPS CORNUTUS.
195. PODICEPS ——— ?
196. PHAETHON AETHEREUS ?
197. LARUS ARGENTATUS ?
198. LARUS ARGENTATUS juv. ?
199. CHRŒCOCEPHALUS ——— ? STERNA ——— ?
200. PELECANUS ——— ? There is nothing to show which species is meant. The name is the same as that Audubon subsequently gave to the white pelican.
201. PROCELLARIA ——— ?
202. RHYNCHOPS NIGRA.
203. TACHYPETES AQUILUS.
204. SULA FIBER.
205. ANOUS STOLIDUS.
206. ÆGIALITIS VOCIFERA.
207. CHARADRIUS VIRGINICUS or SQUATAROLA HELVETICA.
208. ÆGIALITIS SEMIPALMATA or ÆG. MELODA.
209. HÆMATOPUS PALLIATUS.

210. ‖ Fulica Floridana, the great blue or slate coloured coot of Florida.

211. * Rallus Virginianus, the soree bird or little brown rail, also called widgeon in Pennsyl.

212. ‡ R. aquaticus minor, the little dark blue water rail.

213. * R. rufus Americanus, the greater brown rail.

214. ‖ R. major subceruleus, the blue or slate coloured water rail of Florida.

215. * Phoenicopterus ruber, the flamingo, seen about the point of Florida, rarely as far N. as St. Augustine. [a]

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210. Fulica americana.
211. Rallus virginianus or Porzana carolina.
212. Porzana carolina adult?
213. Rallus longirostris or R. elegans.
214. Gallinula galeata? or Porphyrio martinica?
215. Phœnicopterus ruber.

Summary.—Total, 215 species, of which 52 are undetermined in the foregoing commentary. Of the 163 recognized species, many are here given new specific names, the binomial ones of which are to be adopted if found to have priority, otherwise to be entered among current quotations of synonyms. Of the many new binomial and identified names, 20 are believed to have priority. Of these 20, 5 are already in general employ, on Bartram's authority; namely, Nos. 9, 24, 28, 30, 74; and 5 others are in general employ, but attributed to Wilson or Audubon; namely, Nos. 43, 87, 95, 104, 190. This leaves 10 new, identified, binomial names, believed to have priority, and consequently available for use, to supersede later names now in current usage, namely, Nos. 21, 22, 25, 26, 42, 94, 96, 103, 138, 149. Attention is called to the whole of these 20 names, printed in large capitals in the foregoing commentary—but particularly to the 10 last enumerated; likewise, to *Lucar*.

[*a*. Whence the asterisk is evidently misplaced.]

AUGUST 3.

The President, Dr. RUSCHENBERGER, in the chair.

Seventeen members present.

The following papers were presented for publication :—

"On the Batrachia and Reptilia obtained during the Exploration of Talamanca, Costa Rica, by Wm. M. Gabb." By Edw. D. Cope.

"On the Reptilia obtained by Dr. John M. Bransford, U. S. N., during the survey of Nicaragua of 1874." By Edw. D. Cope.

"Studies of the American Falconidæ." By Robt. Ridgway. "No. III. Monograph of the genus Micrastur."

"On the Food and Nidification of certain North American Birds." By Thomas G. Gentry.

"On the occurrence of Uranium, Silver, Iron, etc., in the Tertiary Formation of Colorado Territory." By E. L. Berthoud.

On the Cretaceous Beds of the Galisteo.—Prof. COPE laid on the table a stitched copy of his memoir on the vertebrate fauna of the cretaceous period in the west, being Vol. II. of the 4to. series of Hayden's Reports of the U. S. Geological Survey of the Territories.

Prof. Cope made some remarks on a paper recently published by the American Philosophical Society, entitled the Geological Relations of the Lignitic Groups of the Cretaceous, by Prof. John J. Stevenson. While he regarded the paper as a valuable contribution to the literature of the subject, he thought that some assertions of the author required notice. Thus his remark that vertebrate life is too imperfectly preserved to be ordinarily of much service alone [in fixing geological horizons] could not be concurred in by students of the extinct *vertebrata*. A similar statement respecting fossil remains of plant-life is the following: "Such is the record of plant-life—a record little better than a blank, with here and there a few markings, many of which are too indistinct to be deciphered." This view would naturally not be acceptable to students of fossil plants, nor could it in the nature of things be true. Plants offer too many tangible structural features to be worthless as evidence, and the only remark which can be justly made in criticism of the paleophytologists is that they have not always correlated their results with those of the paleontologists. The failure to insist on the tertiary character of the vegetation of the Fort Union beds of the West, would have rendered less prominent the most important generalization yet derived from the study of that horizon, viz., that a cretaceous fauna was contemporary with a tertiary flora.

Prof. Cope took the opportunity of correcting a misapprehension which had arisen with respect to the age of the Galisteo sandstones of New Mexico. Prof. Stevenson remarks that "a careful comparison of this section, as given by Dr. Hayden, with the details of the geology along Dr. Newberry's route from Santa Fe westward, as given in Ives' report, will, I think, satisfy everybody that Dr. Hayden has by some oversight inverted the order, and that the Galisteo group underlies the coal group. The Galisteo group is unquestionably the Triassic, as abundantly appears from the description of that system in New Mexico, by Newberry and Leconte." Prof. Cope had studied the Galisteo sandstone both on Galisteo Creek and on the eastern slope of the Zandia Mountains. In both localities he found it to underlie cretaceous No. 3, without the intervention of a coal bed. He therefore supposed it to be above the coal, as stated by Dr. Hayden, and a member of the cretaceous series, differing from some of the beds only in its red color. Its resemblance to the Trias he believed to be accidental.

The death of Wm. E. Whitman was announced.

AUGUST 10.

The President, Dr. RUSCHENBERGER, in the chair.

Nineteen members present.

AUGUST 17.

The President, Dr. RUSCHENBERGER, in the chair.

Fifteen members present.

AUGUST 24.

The President, Dr. RUSCHENBERGER, in the chair.

Sixteen members present.

AUGUST 31.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-two members present.

A paper entitled "On the Fossil Remains of Reptiles and Fishes from Illinois," by E. D. Cope, was presented for publication.

Mr. JOSEPH WILLCOX stated that he had observed lately the flight of grasshoppers in Colorado. On a cloudy afternoon the insects were on the wing, high in the air, in countless multitudes. A party of several persons were riding in a carriage and the question of probable rain was discussed. Suddenly the grasshoppers, with great unanimity, descended to the ground, the scene reminding one of a furious snow-storm. In two or three minutes no grasshopper could be seen in the air, and in a short time it commenced to rain. Soon after the rain ceased to fall, the insects took flight again, but in the course of half an hour, without any particular indication of rain, they suddenly plunged to the earth again. Soon after this it rained again. This process was repeated three times on that afternoon, and each descent was followed by a fall of rain.

Genesis of Cassidaria striata, Lam.—Mr. GABB called attention to a series of specimens illustrating the genesis of a recent species of mollusk. About 1850, Geo. B. Sowerby described a fossil from the Miocene formation of Santo Domingo, under the name of *Cassidaria lævigata*, which differed from the recent form *C. striata*, *Lam.*, in being a much more solid shell, with a broader body whorl, with decided varices, more expanded outer lip, markedly produced in a posterior lateral direction, little or no trace of teeth on the inner lip, and with a polished surface, or showing only obsolete traces of striation on the adult shell. The young specimens, however, are always striated, the inner lip is more or less crenulated, and the outer lip is not so expanded as in the adult. On comparing adults of *lævigata* and *striata*, no conchologist would hesitate for a moment in calling them distinct species. Later, a form was described by R. J. L. Guppy from a deposit in Jamaica, of the same geological age as the Dominican beds, and which differs in the adult stage from the Dominican fossils in having the juvenile characters persistent; that is to say, the spire is higher, the not very strong striation covers the body whorl, the thinner inner lip is crenulated throughout its entire length, the outer lip is less expanded and the three varices are only visible externally as trifling irregularities of the lines of growth, although they show internally as perfectly formed lips. This form was called by Mr. Guppy *C. sublævigata*, but in 1873, Mr. Gabb called attention to its small points of difference and reduced the name to the grade of a synomyn of *lævigata*.[1] Later, Mr. Gabb has discovered, in the Pliocene deposits of Costa Rica, another shell, in which the progression of characters is continued. The spire is still higher, the lips less crenulated, the varices suppressed, the surface striation more marked, and, in short, the Costa Rica shell can hardly even be called a variety of *C. striata*, so close is it to the living species; and yet the connection between

[1] Tr. Amer. Philos. Soc. 1873, p. 222.

it and the Jamaica form, and through that with the Dominican, is equally perfect. In short, the shells from Costa Rica and Jamaica are the "missing links" between two well-marked and distinct species.

Galeodea lintea, Conrad (Proc. Phila. Acad. 1852, p. 199), from the Vicksburg Eocene, is a shell of an entirely different type, and, despite the opinion of that author, has no bearing on the present question. It is a true *Cassidaria*, with imperfect varices, and is tuberculated.

EXPLANATION OF THE PLATE.

Fig. 1, 1*a*, 1*b*. *C. lævigata*. Adult.

Fig. 2. *Cassidaria* from Costa Rica.

Fig. 3. *C. lævigata*, young, from Santo Domingo. Type of *C. sublævigata*, Guppy.

Fig. 4. *C. striata*, Lamarck.

The following papers were ordered to be published in the Journal: "On the Batrachia and Reptilia of Costa Rica." By E. D. Cope.

"On the Reptilia obtained by Dr. John N. Bransford, U. S. N., during the survey of Nicaragua of 1874." By E. D. Cope.

The committee to which they had been referred recommended the following papers to be published:—

ON THE OCCURRENCE OF URANIUM, SILVER, IRON, ETC., IN THE TERTIARY FORMATION OF COLORADO TERRITORY.

BY E. L. BERTHOUD.

November 24th, 1874, I was called upon to measure and examine a coal mine called the Lyden Coal Mine, six miles north of Golden, Colorado Territory. The measurement and the examination were required to ascertain precisely what the explorations to that date had done towards striking and opening up one of the largest beds of tertiary coal that lie in the upturned stratification of the Northern Colorado Coal Field, which the exhaustive examinations and reports of Professors Hayden, Lesquereux, Cope, Gardner, and Mauris on the coal fields of the eastern slope of the Rocky Mountains have so largely elucidated; but where close proximity to the cretaceous, and the "*delusion*" of a local inversion, have given some cause for doubts on the part of eminent geologists as to the real position of the beds. But conceiving that this point is now settled, it appears that the "raison d'être" of the dispute lies in offending cretaceous mollusca, that in Wyoming are found regularly above beds of lignite coal, whose position is inferentially identified with that of other formations lying above them that are confessedly acknowledged to be tertiary; until the general "homologies" or succession of beds in Wyoming Territory are more definitely settled, and compared rigorously with our Colorado lignite deposits of like age, we must admit them by force of evidence as cretaceous.

But in the Colorado coal formation east of the mountains the cretaceous fossils we find at the base of the Rocky Mountains are invariably west of the outcrop of coal, and in the descending series; thus we are compelled to believe that this is no longer a question for argument, and we shall speak of this coal field as, without doubt, a tertiary deposit. The Lyden coal mine of Jefferson Co, Colorado Terr., lies in Section Twenty-eight (28), Township 2 S., Range 70 west, C. T., about $1\frac{1}{2}$ miles east of the metamorphic and eruptive rocks of the five ranges of the Rocky Mountains. The trend of the outcrop of cretaceous and tertiary strata that here are locally known as "Hogbacks" is N. 17° to N. 19° west, which is also that of the coal beds intercalated in the tertiary shales, clays, and sandstones. The coal and its accompanying walls are nearly vertical, but they occasionally dip 5°, 7°, 8° to the west, causing a local inversion.

The Lyden coal mine lies in an oblong ridge, isolated mostly in a small basin of erosion one mile north of Ralston Creek.

The ridge, with its weather-worn castellated summit, is 700 or 800 feet wide, and nearly one-half mile long; a parallel outcrop of cretaceous sandstone, dipping east about 30°, and succeeded by a ridge of red sandstone, is found one mile west of the coal outcrop. In order then to reach the coal bed in the cheapest and most expeditious manner, a drift was started from the west slope, and, cutting at right angles to the stratification, reached a distance eastwards of 310 feet horizontal, and over 200 feet below the top edge of the sandstone outcrop. At about 270 feet from the entrance of the drift a small vein of coal was pierced through, about 15″, then two more larger beds, making altogether about five feet of good coal in three beds. Penetrating east some ten feet beyond the last coal bed, the miners were astonished to find, in place of the ten to twelve feet coal bed, the object of their search, an exceedingly hard black vein of mineral matter, containing geodes of brilliant quartz crystals, and small veins of pyrites, the honeycombed mineral full of a green ochrey powder, with veins of chalcedony, and small orange-colored crystals and concretions.

Upon further examination I found that this mineral vein, resembling a very dark hard iron ore, had apparently been thrust up from below as a "dike," that it had taken the place of and destroyed the coal bed that it had apparently obliterated; that the country rock, a soft sandstone with clay shale or fine clay, was disrupted, fragmentary, and in irregular order, the intruded "dike" having the appearance of being the produce, or at least at one time subjected to heat; yet the adjacent rock is but little if any changed, and in the vein we find everywhere in small particles unconsumed coal, but more particularly in the honeycombed portions of the mineral.

Altogether, from the peculiar appearance of the intruded "dike," and its violent intercalation in the recent tertiary strata, we find a complete substitution of the coal took place in this part of the coal outcrop, for by digging upwards good coal is found above the "dike," for another drift has been extended nearly 200 feet or more in a northerly direction on the workable coal bed. But in this drift, after entering on the coal bed from the south end of the "Hogback," in over 60 feet distance the "dike?" or bed of metamorphic iron ore, etc., was reached, cutting off the coal completely. Upon following upwards the face of the intruded bed of ore, the "big coal bed" was again reached in fifteen feet vertical elevation. The mine was worked for a long distance northwards, until a sudden flow of choke-damp killed all the miners, when the last named drift was abandoned, and the new drift driven crosswise to locate and open up the workable coal bed.

Having selected different varieties of the ore that the intruded "dike" contains, and having them analyzed, I find that the intruded "dike" carries from 2 to $\frac{2}{10}$ per cent. of uranium, and 8 oz. bullion; that iron is present in a large proportion, but no zinc or manganese. The coal is of the same general quality as the Murphy, Coal Creek, and Golden coal. It is metamorphosed lignite, and contains 47 to 51 per cent. carbon, $13\frac{1}{2}$ to $19\frac{1}{2}$ per cent. of water, $4\frac{1}{2}$ to 5 per cent. ash, 35 to $32\frac{1}{2}$ per cent. volatile matter. The fossil vegetation of the shale and coal bed sandstones contain fossil leaves of cinnamomum platanus, pharagmites, magnolia platanus, and juglens, etc. etc. One and one-half miles southwest of this mine, and in the cretaceous outcrop one-half mile west of Murphy's mine, we find the summit of the Hogback formed by a "dike" of erupted basalt or dolerite whose course is nearly on the meridian.

Notes on Mr. Berthoud's Paper.—Dr. George A. Kœnig remarked that the facts detailed in the above paper are of great interest, but the Academy cannot endorse the author's views upon the origin of this mineral deposit. There was a time when anything unusual in the earth's architecture was attributed to the mischievous agents of the great fiery abyss.

But chemical investigation has proved that all the fissure veins, as well as stratified ore beds, are the result of a long process of reduction, crystallization, and deposition of mineral substance from aqueous solution.

While in many cases the satisfactory explanation of disturbances in stratified rocks and especially mineral veins and coal beds is very difficult with our present knowledge, nay impossible, yet in this instance, there is no difficulty, nor even anything strange.

The ore deposit is perfectly conformable with the strike and dip of the coal bed; mining operations have developed the presence of coal above the ore, and, no doubt, would reveal it below the level of the drift, if a shaft were sunk to the requisite depth. The presence of geodes of fine quartz crystals and chalcedony, as also the presence of pyrite, excludes all idea of igneous origin (*à priori*), and makes the ore deposit analogous to the filling of fissure veins by the process of infiltration. The infiltration may have been *synchronic* with the deposition of the organic matter forming the coal bed, as undoubtedly the masses of iron carbonate and iron oxides in the coal beds of many localities were; or it may have taken place by replacement at a later period. To decide about these two ways, it would be necessary to examine the deposit more closely than has apparently been done. But either of them is consistent with the chemico-geological theories now held by geologists.

PHILADELPHIA, August 14th, 1875.

Mr. GABB remarked that while the observation given in Mr. Berthoud's paper was interesting, the writer's deduction was evidently at fault. From the description of the facts as given, it seemed to be a case of replacement by segregation, similar to that which occurs in the manganese mine of "Red Rock" in the bay of San Francisco, where beds of metamorphosed cretaceous shale are pseudomorphed by segregated masses of black oxide of manganese; in many parts the original bedding of the siliceous rock being retained, but the material consisting of nearly pure metallic oxide.

THE PHYSIOLOGICAL ACTION OF HEMLOCK AND ITS ALKALOID.

BY B. F. LAUTENBACH, M.D.

The ancient Greek physicians possessed a more accurate knowledge of the physiological effects of conium than was acquired by more modern investigators until a comparatively recent period. So late as the year 1845, a well-ascertained and carefully observed case of poisoning by hemlock disclosed truths respecting its toxical action which had laid dormant for centuries. An occasional ray of light has indeed appeared to those who from time to time have sought to determine the properties of the plant: but the general state of our knowledge may be summed up in the words of a very eminent therapeutist. About sixteen years ago Pareira (Elem. Mat. Med., vii.) wrote: "In the present state of uncertainty with respect to the real physiological operation of hemlock, it is obviously impossible to lay down indications or contra-indications for its use which can be much relied on."

Since these words were written a number of investigators have appeared in the field, the majority of whom have been content with studying the most marked symptom of hemlock-poisoning, *i. e.*, paralysis, while a few announced idle theories in regard to its action, which others have again disproved. Reference to the most modern treatises on therapeutics shows that very little, apart from its bare toxical effects, is known of its physiological operation, and the little that is known is involved in such a mass of contradictory evidence as to have led some authorities to ignore it altogether.

As conia represents the entire active principle of hemlock, I shall confine my observations almost exclusively to it.

In man the chief symptom produced, when conia is taken in doses just sufficient to decidedly impress the system, is great muscular weakness; this is accompanied by giddiness, and occasionally by disorder of vision. There is an intense desire to lie quiet in a semi-horizontal position, and owing to the heaviness of the eyelids which now occurs, the eyes are kept shut, thus giving rise to the impression that the person is asleep. On attempting to walk the subject's feet feel as though they did not belong to him, and he falls from his knees refusing him support. The pulse is at first increased and afterwards decreased in frequency. Sooner or later, as the drug impresses the system, the pupils dilate. In some persons these symptoms are accompanied, rarely preceded, by symptoms of gastro-intestinal irritation, nausea, and rarely vomiting. If the dose be a poisonous one, we have, in addition to these symptons, total failure of voluntary motion and convulsive movements occurring (vide a case of poisoning by hemlock leaves reported by Dr. Bennett in Edin. Med. and Surg. Journ. for 1845).

A close physiological study of conia can best be made by investigating its effects on the different systems, seriatim, and this method I shall endeavor to follow.

Physiological Effects on Vegetables.

Worcet (Amer. Chem. et Phys. xxix. 21, 9) placed a haricot plant (Phaseolus vulgaris) in a solution of five grains of the extract of hemlock; in a few minutes the two lower leaves curled at their extremities; the next day they were yellow and subsequently died. The experiments of Schübler and Zeller (Schweiger's Journ. f. d. Chem. B. 1, S. 54) confirm this poisonous action of the extract. The same results were obtained in several experiments made by the writer.

Exp. 1. 11.55 A. M., placed two plants (Ailánthus glandulosus) of equal age, growth, etc., in separate bottles; bottle number one containing a seven-grain solution of extract of hemlock, while bottle number two contained an equal quantity of pure water. 3.05 P. M., the plant placed in bottle number two is in as good condition as when first placed there, while the plant in bottle number one is drooping. 5.30 P. M., the lower leaves of the plant in the hemlock solution are curled at their extremities, while the plant in water is still in an excellent condition. 9.30 P. M., the plant in water is still unchanged, but the lower leaves of the other plant are more curled than before, while the upper leaves and branches hang down the sides of the bottle. The next day at 6. A. M. the lower leaves of the plant in the hemlock solution were dry and brittle, while the other plant remains unchanged. On the third day at 10.30 P. M., the entire plant which was in the hemlock solution was dry and brittle, while the plant which was placed in water had undergone little or no change.

Exps. 2 and 3 gave identical results.

That this poisonous action of the extract of hemlock is due to impurities and not to the exceedingly small quantity of conia which it contains, was shown by the following experiment:—

Exp. 4. Placed two young ailanthus plants in bottles, one bottle containing a one-grain solution of conia, and the other containing pure water. In three and a half days the plant placed in water drooped, and on the fifth day it was dry and brittle, while the plant placed in the conia solution did not droop until the eighth day.

This experiment, taken in connection with another which gave similar results, proves that conia, instead of acting injuriously on plants, really preserves them from decay. As the alkaloid had to be dissolved in a small amount of alcohol, the thought suggested itself that the preservative action was due to the alcohol; but, in the experiments made by the writer to determine this point, it was ascertained that alcohol, instead of acting as a preservator of plants, really hastens their destruction, probably by coagulating their albumem.

Local Action.

A study of the local action of the drug shows that it causes a progressive loss of functional power in all the highly-organized tissues with which it comes in contact. Nerve-centres, peripheral nerves, muscles, both striated and unstriated, all succumb to it alike. If such contact be not continued too long, the tissue may recover, even after a total suppression of its function—a proof that the alkaloid exerts no destructive caustic influence upon the tissues, as was claimed by Van Praag. Excluding the burning pain and the anæsthesia which follow, I have never observed any action on the tongue even if the alkaloid was placed on this most sensitive organ undiluted.

In opposition to the above conclusions I must cite the statement of Van Praag (Reil's Journal of Pharmacodynamik, Hft. i. S. 33), who says that he found conia to act as a caustic when locally applied. The following experiments prove the correctness of the conclusions above given, and consequently the falsity of Van Praag's conclusion.

Exp. 5. Placed one grain of conia on my arm ; in two minutes the spot was red and painful, but in five minutes on pricking the spot with a needle no pain is produced ; the redness remained several hours.

Exp. 6. Exposed the gastrocnemii of the hind extremities of a frog; the right was painted with a one-grain solution of conia. In two minutes galvanism of the right gastrocnemius did not cause it to contract, while the left contracts on slight irritation. In several hours, however, the right gastrocnemius regained its power of responding to galvanic irritation.

Exp. 7. Exposed the spinal cord of a frog, and applied to it in the dorsal region a one-grain solution of conia at 11.39. 11.39¼, voluntary movements have ceased posteriorly; irritation anteriorly causes no movements posteriorly, while irritation posteriorly, though it causes movements posteriorly, will not cause movements anteriorly. 11.39¾, galvanization of the cord above the point where the drug was applied causes movements anteriorly but none posteriorly, while galvanization below the point of application causes movements posteriorly; thus proving that when locally applied to the spinal cord entire loss of functional power occurs at the point of application.

The drug has a similar action on the nerve trunks, for when a weak solution of the alkaloid was applied to the sciatic nerve of a mouse or frog, galvanization of the nerve above the point of application caused no contractions in the tributary muscles, but if the nerve was galvanized below the point of application contractions occurred in the tributary muscles.

The following experiments show that when locally applied to the brain of frogs conia produces immediate clonic convulsions; this is curious from the circumstance that ordinarily cerebral convulsions do not occur in batrachians.

Exp. 8. On a medium-sized frog, 5.41, a very weak solution of conia injected on the brain causes spasms immediately, 5.45, galvanization and mechanical irritation cause spasms all over the body.

Exp. 9. 6.30, a weak solution of conia was injected on the brain of a medium-sized frog, producing immediate clonic convulsions. 6.33, spasms occur with every respiratory movement.

Action on the Nervous System.

On the Brain.—It has been announced by a number of investigators that conium, like opium, produces sleep, but the drug has no such hypnotic action. Reuling and Saltzer (Deuts. Klin. 1853, No. 40) mention an experiment in which, ten minutes after the drug was given, unconsciousness occurred, from which the animal could not be aroused. These experimenters must have been misled by the paralysis making the expression of pain absolutely impossible; in this state of affairs the eyelids are drawn together, giving still more the appearance of sleep; or from their conia being contaminated.

The state to which I have just alluded as resembling sleep is certainly not sleep, for when the abdominal aorta of a frog is tied and conia injected into the anterior part of the body, paralysis occurs anteriorly and the animal passes into this state of seeming sleep, while posteriorly, voluntary movements continue until late in the case, when paralysis of the spinal motor tract prevents all movements. Had this been sleep, voluntary movements posteriorly would have been absolutely impossible. After taking a grain and a quarter of the alkaloid I once passed into this state of seeming sleep; that this was not sleep was shown by the circumstance that consciousness was not lost, though the power over the various muscles of expression was entirely gone for the time being.

It is possible, however, that the brain becomes slightly clouded, but not to the extent to produce unconsciousness. In inducing complete repose of the muscular system, conia powerfully predisposes the brain for sleep—brings sleep within its reach, so to speak, but there leaves it. If the imagination should happen to be dull, the brain may accept the invitation, and sleep occurs.

As the convulsions of conia-poisoning are certainly cerebral, I shall now proceed to investigate this serious symptom, which really signifies that death is imminent.

Convulsions were early mentioned as symptoms of poisoning by hemlock, but the cause of these convulsions had never been determined. Christison (Trans. Roy. Soc. Ed., xiii. p. 383) imagined them to be due to a depressing action on the spinal cord, while Damourette and Pelvette (Gaz. Méd. de Paris, 37, 1870) attributed them to excitation of the cord.

It is very plain that the convulsions can be produced in but five different ways: first, they may be spinal; second, they may be due to stimulation of the peripheral ends of the motor nerves; third, they may be caused by irritation of the peripheral ends of the sensory nerves; fourth, they may be muscular; fifth, they may be cerebral.

That the convulsions of conia-poisoning are not due to irritation of either the peripheral motor or sensory nerves, nor to any direct action on the muscles, was readily proved by tying the abdominal aorta of various animals, and then injecting the drug into the anterior portion of the body, when, notwithstanding the fact that the posterior part of the body was completely cut off from the poison, convulsions occurred uniformly over the whole body.

Exp. 10. On a small male cat. Tied the left femoral artery, and, at 2.01, injected five drops of the alkaloid into the peritoneum. 12.07, repeated clonic convulsions occur over the whole animal, the left leg continuing convulsed after the others are quiet.

Exp. 11. On a very large male cat. Tied the abdominal aorta, and at 12.54, injected six drops of conia into the peritoneum. 12.57, spasms all over the body.

Exp. 12. On a young female cat. Tied the left femoral vessels, and at 5.52, injected five and a half drops of the alkaloid into the peritoneum. 5.56, convulsions, most marked in the ligatured limb.

Exp. 13. Tied the abdominal aorta of a very large mouse. 3.47½, injected one drop of conia into the anterior part of the body. 3.49, convulsions, more marked posteriorly than anteriorly.

That the convulsions are not due to irritation of the peripheral motor nerves, and that they are not muscular, was also proved by the following experiment:—

Exp. 14. Amputated a leg of a cat, and then injected an ounce of a grain solution of conia into the femoral artery. The sciatic nerve no longer caused contractions if irritated, but no spasms were produced.

The convulsions must, therefore, be either spinal or cerebral; the following experiments prove that they are not spinal:—

Exp. 15. Cut the spinal cord of a large mouse in the dorsal region. 3.47½, injected one drop of conia into the anterior portion of the body. 3.50, violent convulsions anteriorly, none at all posteriorly. 3.50½, the animal is dead.

Exp. 16. Cut the cord of a large mouse, and then injected one drop of conia into the peritoneum. In several minutes clonic convulsions occurred anteriorly, but none occurred posteriorly.

Exp. 17. On a young cat, whose cord had been cut in the dorsal region. On injecting conia, spasms had occurred in the anterior limbs, but none occurred posterior to the section.

The inevitable conclusion from these experiments is, that the convulsions of conia-poisoning are cerebral, and not spinal, as Christison supposed.

These convulsions, according to Van Praag (loc. cit.), are always tonic in birds and fishes, but they may be either clonic or tonic in mammals; they never occur in the batrachian, except when the drug is directly applied to the brain, when they invariably are present.

Action on the Spinal Cord.—On this subject the conclusions, or, more correctly, suppositions, of different investigators are at variance. Christison (loc. cit.), Van Praag (loc. cit.), and Verigo (Schmidt's Jahrbücher, Bd. cxlix. S. 16) say that it acts forcibly as a depressant. Verigo is most positive in his declaration that all the symptoms of conia-poisoning, except paralysis, may be attributed to its depressing action on the cord. Casaubow (Practitioner, 1869) and Pelvette and Martin Damourette (loc. cit.) have come to a directly opposite conclusion, they believing that the drug is a spinal excitant. Pelvette and Damourette write: "Its excitability is but little influenced by feeble poisonous doses, since these do not produce convulsions at first, since the voluntary and reflex movements persist until the end in the frog, and since cold-blooded animals succumb without any marked change of the intellectual or instructive faculties." . . . . "With strong doses there exists an undoubted increase of excitability of the nervous centres, which is evidenced by tetanic movements and convulsive tremblings, and marked a little later by paralysis of the motor extremities. All our experiments place beyond doubt this exaltation of the spinal motor centres."

There are several points in this statement with which the writer must disagree: first, they say "the voluntary and reflex movements persist until the end in the frog, where feeble poisonous doses are given." The writer has given conia to more than a hundred frogs, thirteen of whom recovered, and, except where the principal artery of a limb was tied, in all of them complete abolition of voluntary and reflex movements occurred at some period of the poisoning. The two following are illustrative experiments:—

Exp. 18. On a medium-sized frog. 7.43, injected $\frac{1}{200}$ of a drop into the abdomen. 7.43$\frac{3}{4}$, neither voluntary nor reflex movements can be excited by the strongest current applied to the sciatic nerve.

Exp. 19. On a small frog. 2.04, injected $\frac{1}{600}$ of a grain into the abdomen. 2.08, voluntary and reflex movements still occur; 2.14, neither voluntary nor reflex movements occur, not even when the animal was irritated by galvanism. In twenty hours the animal had recovered its motive powers and was used for another experiment.

These investigators seem to imply that the convulsions are due to exaltation of the motor tract of the cord, which is far from being the case, but as they were proved to be cerebral when speak ing of conia's action on the brain, nothing further need be said on the subject at present. Again, these investigators write: "With strong doses there exists an undoubted increase of the excitability of the motor centres which is evidenced by a marked paralysis of the motor extremities of nerves." How paralysis of the motor extremities of nerves proves an excitability of the motor centres is beyond the writer's comprehension, for to ordinary minds paralysis of the motor extremities of nerves is always associated with some depressing influence on the nervous centres or on the nerves themselves.

Further on in their remarks these experimenters state that the primary increase in the number of respiratory movements is due to an increased excitability of the bulbo-spinal centres, but, as the writer ascertained, that when the pneumogastrics were cut and conia given, no increase in the number of respiratory movements occurs, their view of the matter is hardly tenable.

As all the investigators have merely recorded their conclusions without the experiments on which their conclusions were based, the only way to determine the action of conia on the spinal motor tract was to go over the whole ground anew; in doing this, thirty-four experiments were made by the writer, several of which with conclusions will now be recorded.

Exp. 20. On a very large frog. A drop of acetic acid placed on its foot caused immediate reflex movements; these movements are also excited by a very weak galvanic current applied to the foot. 1.39$\frac{1}{4}$, injected one-quarter drop of conia. 1.39$\frac{1}{2}$, a drop of acetic acid placed on the foot causes reflex movements in three seconds. 1.39$\frac{3}{4}$, it takes a much stronger galvanic current to produce reflex movements than previous to the injection. 1.50$\frac{1}{2}$, the acetic acid caused movements in six seconds. 1.57, the acetic acid will no longer cause reflex movements. 2.04, it takes the strongest galvanic current to produce reflex movements. 2.10, the strongest current no longer causes reflex movements, but the animal continues to breathe until 2.19.

This experiment, when taken in connection with thirteen others which yielded similar results, proves that early in conia-poisoning there exists no increased excitability of the cord, as is claimed by Casaubow (loc. cit.), Pelvette and Damourette (loc. cit.), for if there had been, the acetic acid would have produced reflex movements more rapidly, instead of more slowly, after injecting the conia, and it would have taken a much weaker, instead of a much stronger current to produce reflex movements. These experiments also render it probable that the action on the cord is one of depression, but this is uncertain, as the later symptoms of depression might be caused by the paralysis of the terminal extremities of the efferent nerves. To obviate this source of error, all the bloodvessels of a frog's leg were tied and the experiments repeated.

Exp. 21. On a large frog. Tied all the bloodvessels of the left posterior extremity, carefully excluding the nerves; the weakest current that would cause reflex movements in the injured limb was then determined. 3.58, injected one-eighth drop of conia. 3.59, acetic acid applied causes no reflex movements (previous to the injection it caused movements in one second). 4.01, it takes the strongest current to produce reflex movements in the ligatured limb.

Exp. 22. Tied all the bloodvessels of the left posterior extremity of a large frog, and then determined the weakest current which would cause reflex movements in the injured limb. 4.15, injected one-eighth drop of conia. 4.16¼, a much stronger current is required to produce reflex movements in the ligatured limb. 4.20, the strongest current applied to the ligatured limb will not cause reflex movements, though respiration continues and galvanization of the spinal cord causes movements in the ligatured limb.

As the ligatured limb, in the last-mentioned experiments, failed to respond to irritants after the access of the drug to the trunks and periphery of the nerves was prevented, this failure must have been due to paresis of the spinal marrow, and not to paralysis of either the afferent or efferent nerve-fibres. It is therefore proven, that, instead of there being a stage of spinal excitement, there is, on the contrary, a steadily progressive stage of spinal depression.

Complete paralysis of the spinal cord is the last effect of a poisonous dose of conia, for the instant that the cord ceases to respond to galvanism, respiration ceases and death occurs.

Action on the Periphery of the Efferent Nerves.—To discuss this subject is really to discuss what has long been considered and beyond a doubt is the chief symptom of hemlock-poisoning; namely, paralysis. The cause of this paralysis has occasioned great dispute among investigators since 1835, when Christison (loc. cit.) announced that it was due to paralysis of the spinal cord; this was denied by Albers (Deuts. Klin. 1853, No. 34), who believed it to be "due to the action which conia has on the brain." Reuling and Saltzer (loc. cit.) and Van Praag (loc. cit.) agree with Christison in attributing the paralysis to the action on the spinal cord.

The first person who threw any real light on the subject was Kölliker (Virchow's Archiv, Bd. x. S. 228). In 1856, this distinguished investigator announced that the failure of motion in conia-poisoning is due to a direct action of the alkaloid upon the periphery of the efferent or motor nerves. He first experimentally proved that in frogs killed by conia the application of the galvanic current to a nerve fails to induce contractions in the tributary muscles. He then cut off the supply of blood to the hind extremities, and found that after voluntary motion had ceased anteriorly, and even after galvanic irritation of the anterior nerves had lost its influence upon the muscle directly supplied by these nerves, irritation of the same anterior nerves caused reflex contractions in the posterior extremities, thus showing that the anterior afferent nerves and the spinal cord still retained functional activity after the loss of it in all those efferent nerves reached by the poison. He then extended his experiments by severing in a frog all the tissues at the upper part of the thigh except the nerve, and found that when an animal so prepared was poisoned by conia, after the paralysis was complete in all the extremities to which the poison had access—after stimulation of the poisoned nerves failed to excite contractions in the tributary muscles—the leg which had been protected from the action of the drug, responded not only to irritation applied to its nerve, but also to stimuli placed upon distant portions of the body. After repeating these experiments several times, he drew the conclusion previously given.

His results have been confirmed by Gultman (Reil. Mat. Med. d. Chem. Pflanzenstoffe), and by Verigo (Deuts. Zeitschr. of Arzneikunde, xxviii. 2, 1870), and by the writer in a large number of experiments. They have been denied by Dyce-Brown and Davidson (Med. Times and Gaz., July, 1870), on account of the directly opposite results which they obtained in the following experiments:—

"1. In a young cat the femoral vessels of one side were ligated under chloroform. The animal was allowed to recover from its effects, when it was found that the limb operated upon was quite as freely movable as in the uninjured leg, showing that the nervous cords had not been included with the vessels. Soon after the poison had been administered the hind legs began to move feebly, the ligatured one being equally affected with the sound one, and the two advanced *pari passu* in the general paralysis."

"2. A full-grown rabbit was treated in precisely the same way and gave identical results, the hind limb which had been operated on becoming gradually paralyzed in the same ratio as the other."

As these experiments will have to be discussed further on in this paper, I will defer my criticism until then.

Recently, upon the foundation of a single, crude, and inconclusive experiment, Harley (Old Vegetable Neurotics, p. 11) re-advanced the opinion, formerly held by Albers, that conia affects chiefly the corpora striata, and the other nervous centres at the base of the brain, supposed to mediate between the will and spinal cord. The following is the experiment from which he draws his conclusions:—

"At 5.30 P. M., August 23, I injected ♏xv of the Succus conii beneath the skin of a full-grown, active, male mouse. Seven minutes afterwards he began to stumble; at the tenth minute he tumbled over several times while sitting, kangaroo fashion, upon his hind legs cleaning his face. Up to the twentieth minute the little animal continued tolerably active and self-possessed, getting up as if nothing was the matter, as often as, in sitting or walking, he happened to roll upon his side. He now gathered himself together in his usual crouching posture, and resting his nose upon the table became very still and dull, with the eyes partially closed; respirations 160—the normal rate—and regular. When aroused he was unable to run, and on attempting to walk he rolled over on the side. Without any visible change or movement, the little animal now passed into a state of complete paralysis, in which he remained until 8.15 P. M.—two hours and three-quarters after the dose was given. During the whole of this time he lay motionless in the position in which he was placed, with his eyes nearly closed, perfectly flaccid, and exhibiting no indication of sensibility when dangled by the tail, or an ear, or a toe. As he lay upon the side the only indications of life throughout this period were the following: distinct and regular respiratory movements of the sides of the chest and abdomen, decreasing during the two hours from 160 to 135, and interrupted by one or two full swelling inspirations during the minute. On gently passing the point of the pencil along the half-closed margins of the eyelids, a sluggish contraction, so faint as to be scarcely perceptible, occurred; but on separating the lids and touching the cornea no contractile action of m. orbicularis was observable. On rolling the rump portion of the tail gently between the thumb and finger a reflex movement, consisting of a sudden jerk, of all four legs was simultaneously excited; the vibrissæ were at the same time momentarily agitated. At 8.15 P. M., the effects of the hemlock began to subside, as indicated by a little increase in the depth of the respirations, which were 135, and on irritating the tail as above mentioned, the head, body, and legs were simultaneously jerked backwards, the general movement being such as to throw the body backwards nearly an inch. The eyes were at the same time opened and the vibrissæ strongly worked. Shortly afterwards there was a slight movement in the fore paws, apparently of a voluntary nature—the first performed since the paralysis came on. But there was no further movement until 9 P. M., when on disturbing him as he lay upon his side, he struggled forwards a little, but did not succeed in getting upon his legs. This, however, was accomplished when I again disturbed him at 9.50 P. M., and he then drew himself together, opened his eyes, and began to look about him and sniff for food. Shortly afterwards he crawled a few paces, and meeting with a piece of bread and butter he licked off the butter, and then sat down on his haunches and cleaned his fore paws. At 11 P. M., he was in his usual condition (r. 140). The next day the little animal was as lively and as active as ever (r. 160), and has continued so up to the present day, August 28."

After studying this experiment again and again, one cannot help being struck with the circumstance of so eminent a physiologist and therapeutist drawing such an unwarrantable conclusion. He must have been either totally ignorant of, or he entirely ignores the investigations of Kölliker, Gultman, and Verigo. Had he attempted to galvanize one of the sciatic nerves of the paralyzed animal, he would, nay could, never have made such a mistake.

Besides this experiment the only reason that Harley gives for believing that the corpora striata are the parts affected, "is the extreme rapidity with which the paralyzing influence radiates through the body." For the same reason it might be said that the strychnia convulsions are cerebral, or that the paralysis of physostigma and atropia were due to a similar action on the corpora striata.

After studying the various papers on the subject, it will be seen that the cause of the paralysis is still somewhat undecided. It is very plain that it can be produced in four different ways: first, it may be cerebral, *i. e.*, due to a direct action on the motor centres within the brain; second, it may be due to spinal paralysis; third, it may be muscular, *i. e.*, due to a direct action on the muscles; fourth, it may be peripheral, *i. e.*, due to paralysis of the peripheral ends of the efferent or motor nerves.

That the paralysis of conia-poisoning is not muscular is proved by the fact, which has frequently been noted, and which the writer has repeatedly confirmed, that muscles taken from an animal completely paralyzed by conia—paralyzed to such an extent that galvanic irritation through the nerves fails to excite contractions — can be made to contract most energetically when the galvanic current is applied directly to the muscles. Nay, further, the irritability of the muscles through which the blood poisoned by conia has been permitted to pass is as great and as long continued as that of muscles of the same animal protected from the action of the poisoned blood by ligature of the bloodvessels.

Before discussing the question of the cause of the paralysis any further I can probably make the remainder of my experiments clearer by giving an account of several which were made to discover whether or not the application of the galvanic current to the nerves of an animal paralyzed by conia will produce contractions in the tributary muscles.

Exp. 23. On a large frog. The right sciatic nerve exposed and galvanized; it responds to a very weak current. 3.47, injected one-twentieth of a drop of conia. 3.53, the right sciatic no longer responds to a weak current. 3.55, the strongest current applied to the sciatic nerves barely causes movements in the tributary muscles. 3.57, neither sciatic responds to the strongest current.

Exp. 24. On a medium-sized frog. 4.45, injected one-eighth drop into the abdomen. 4.55, paralysis is complete, neither of the sciatic or median nerves respond to the strongest galvanic current.

Having thus determined that galvanic irritation applied to the nerves of batrachians, paralyzed by conia, fails to induce contractions in the tributary muscles, I then proceeded to determine whether or not the same loss of irritability occurs in the nerves of mammals.

Exp. 25. On a large mouse. 1.56, injected one-half drop of conia into the peritoneum. 2.01, paralysis is complete posteriorly, and paresis anteriorly. 2.05, paralysis anterior; exposed and galvanized the sciatics without producing any contractions in the tributary muscles.

Exp. 26. On a large cat. 5.10, injected six drops of the drug into the peritoneum. 5.17, paralysis complete both anteriorly and posteriorly. 5.17½, exposed the sciatics, they will not respond to the strongest current.

The only instances in which the sciatics continued to respond after the paralysis occurred, were experiments 44 and 45, but these are only mentioned as exceptions here, as further on they are given in full with explanations.

The following experiments were made to determine whether the paralysis was cerebral or not.

Exp. 27. The spinal cord of a large mouse was cut at the tenth dorsal vertebra; irritation posterior causes reflex movements in the hind extremities. 3.47½, injected one-half drop of conia into the peritoneum. 3.50½, anterior paralysis; irritation posterior no longer causes reflex movements. The sciatics do not respond to galvanism.

Exp. 28. I repeated the last experiment, with similar results, on a medium-sized female cat. 5.52, injected four drops into the peritoneum. 6.02, paralysis anterior; reflex movements ceased posterior, and at the same time the sciatic and median nerves ceased to respond to galvanism.

These experiments show, that, if an animal is poisoned by conia after the spinal cord has been cut, galvanic irritation applied to the nerves whose communication with the brain is destroyed, like galvanic irritation applied to the nerves still in communication with the brain, fails to excite contractions in the tributary muscles. They also show that the moment that paralysis occurs in those extremities still in communication with the brain, reflex movements cease in the extremities whose communication with the brain has been destroyed.

Having thus proved that the paralysis is not cerebral, there still remain two possible causes: first, paralysis of the spinal cord; second, paralysis of the peripheral ends of the motor nerves. To determine which of these was the cause, I made a long series of experiments, a number of which will now be recorded.

Exp. 29. The left femoral artery of a cat was tied, and three drops of conia were injected into the peritoneum. In three minutes paresis occurred in the right posterior extremity, and in four minutes paresis occurred in both anterior extremities, while the left posterior extremity moved freely. The cat continued in this state for about an hour, when it commenced to recover.

Exp. 30. Into the femoral vein of the same cat six drops of conia were injected twenty-four hours after the above experiment. In ten seconds, complete paralysis except in the ligatured leg, where movements continue though they are slightly impaired.

Exp. 31. Tied the left femoral artery of a very large cat. 3.03, injected four drops of conia into the femoral vein. 3.03$\frac{1}{4}$, paralysis of all the limbs except the ligatured one, where movements continue though they are slightly impaired. 3.04, galvanization of the right sciatic nerve causes no contractions, but galvanization of the left sciatic causes contractions in its tributary muscles.

Exps. 32, 33, 34, and 35. Repeated the last experiment on four cats, with similar results.

Results similar to these were obtained when frogs were experimented with, as will be shown by the following experiment.

Exp. 36. Tied the abdominal aorta of a medium-sized frog. 4.13, injected one-fourth drop of conia into the anterior portion of the body. 4.17$\frac{1}{2}$, paralysis is complete anteriorly, but voluntary and reflex movements persist posteriorly. 4.20, the sciatics respond to a weak current, but the median nerves will not respond to the strongest current.

I tied the abdominal aorta and then gave conia to twenty-seven other frogs, and always obtained results similar to those obtained in Experiment 36. In the two following experiments the sciatic nerve of one side was cut, while the main artery of the other hind leg was tied; so soon as anterior paralysis occurred the peripheral end of the cut sciatic ceased to respond when galvanism was applied, while on the ligatured side the sciatic when irritated caused contractions until long after death.

Exp. 37. Tied the left popliteal artery and cut the right sciatic nerve of a frog. Both sciatics respond equally well to galvanism. 3.09, injected one-quarter drop of conia beneath skin of the back. 3.17, paralysis complete, excepting the left leg. 3.18, galvanized the peripheral end of the right sciatic without producing any contractions, while galvanism applied to the left sciatic causes contractions in its tributary muscles.

Exp. 38. Another frog was treated in exactly the same manner and gave identical results. After paralysis had occurred in the two uninjured extremities, galvanism was applied to the cut sciatic with no effect, and then to the sciatic isolated from the poison by ligature of the main artery, producing contractions in its tributary muscles.

In the two following experiments I separated in frogs all the tissues at the upper part of one of the thighs except the nerve; conia was then given, and after paralysis had occurred this nerve continued to respond to irritants, while the nerve on the opposite side refused to conduct impressions.

Exp. 39. Separated in a frog all the tissues at the upper part of the left thigh, except the nerve. 2.13, poisoned the animal with one-twentieth drop of conia. 2.21, paralysis complete in all portions of the body to which the poison has access; after galvanic stimulation of the right sciatic and of the median nerves failed to excite contractions in the tributary muscles, the left leg responded not only to irritation applied to its nerve, but also to galvanic stimulation applied to other portions of the body.

Exp. 40. Repeated the last experiment with similar results.

These experiments show that when the direct access of the poison to a limb is prevented, that limb never becomes paralyzed; thus proving that the paralysis must be due to the action on the efferent or motor nerves.

If any further proof be wanted of this action of conia on the periphery of the efferent nerves, I think that the following experiment (one of four, all giving similar results) must put an end to all doubts.

Exp. 41. Killed a cat with chloroform, and then cut off both posterior extremities at the hip-joint. Into the left femoral artery I injected a one-grain solution of conia, while into the right ordinary water was injected. In thirty seconds the application of the galvanic current to the left sciatic nerve causes no response, while its application to the right sciatic caused contractions in its tributary muscles.

The same results were obtained in the following experiments in which conia and strychnia were given simultaneously.

Exp. 42. Injected conia and strychnia into the abdomen of a frog from whose posterior extremities direct access of the poison had been cut off by tying the abdominal aorta; by their conjoint action they produced a commingling of paralysis in all other parts of the body with violent tetanic spasms in the protected limbs. This commingling would have been impossible if the paralysis was spinal or cerebral, and can only be explained on the supposition that conia paralyzes all the motor nerves with which it comes in contact.

Exp. 43. Severed in a frog all the tissues at the upper part of the right thigh except the nerve, and then injected one-twentieth drop of conia with one-sixtieth grain of strychina. In seven minutes paralysis in all other parts of the body with the peculiar strychnia convulsions in the right leg.

The two experiments of Dyce-Brown and Davidson (previously given in full), seemingly prove that the paralysis is either spinal or cerebral and not peripheral ; there can, however, be but little importance attached to them, as the effect of galvanism on the spine and on the nerve of the ligatured limb was not observed. In a single experiment I obtained results similar to those obtained by these experimenters, but the reason for this was soon made clear by finding an anomaly in the external iliac artery ; this vessel, instead of being solely continuous with the femoral, gave rise to a large branch which passed directly to the back of the leg, becoming popliteal. I have observed the same anomaly in five dogs, seven cats, and two mice, and in frogs this anomalous distribution occurs so often that it is probably the rule with them and not the exception. In several dissections of various animals I have seen the internal iliac pass down the back of the leg while there was a very small femoral in front. It is very probable, had a dissection been made, that the unusual results obtained by Brown and Davidson would have been explained by some anomalous distribution of the arteries.

The two following experiments I am unable to explain except on the supposition that conia has a double action on the motor nervous system; a paralyzing action on the peripheral ends of the efferent or motor nerves, and a depressing action on the motor tract of the spinal cord; that in almost all cases the former occurs first and predominates, the paralysis of the spinal cord not occurring until the period of death, yet in a few instances the former does not occur at all and the latter becomes more marked than usual. The experiments to which I allude are the following:—

Exp. 44. Tied the left femoral artery of a young cat. 12.05, injected five drops of conia into the peritoneum. 12.17, paralysis all over the body, not even excepting the ligatured limb; the application of the galvanic current to either sciatic causes as strong contractions in the tributary muscles, as it did previous to injecting the conia (showing that the peripheral ends of the motor nerves were not paralyzed). I then opened the spine and galvanized the cord without producing any movements in the extremities.

Exp. 45. Tied the left external iliac of a young cat. 5.10, injected three-quarters of a drop of conia into the femoral vein. 5.25, no paralysis. 5.25½, injected one drop into the femoral vein. 5.36½, no paralysis. 5.37½, injected two drops. 5.51, slight paresis, equally marked in the ligatured as in the uninjured extremities. 5.52, injected two drops. 5.55, complete paralysis all over the body, not excepting the ligatured limb. Galvanization of either sciatic causes strong contractions in the tributary muscles, while galvanization of the spine produces no effect.

Action on the Periphery of the Afferent Nerves.—Except the loss of irritability of the eyes the sensory nervous system has always been supposed to remain unaffected in conia-poisoning. In some of the earlier experiments made by the writer evidences were seen which threw doubts on this supposition, but, later, when the following experiments were made, especially to determine this point, these doubts became certainties.

Exp. 46. Tied the abdominal aorta and left axillary artery of a medium-sized frog. 2.49, injected one-eighth drop of conia into the abdomen. 2.58, the right fore leg is paralyzed, the rest of the extremities move freely. One pole of a galvanic battery on the spinal cord and the other on the left fore leg causes reflex movements in the hind legs, while with the same pole on the spine and the other on the right fore leg, the same current being applied, no reflex movements occurred.

Exps. 47 and 48. Repeated the last experiment with similar results.

These experiments not only prove that sensation is impaired, but, as this impairment did not occur in the ligatured anterior extremity and was very manifest in the uninjured extremity, it must have been due to the action of the drug on the periphery of the afferent or sensory nerves.

In opposition to these conclusions could be cited all investigators on hemlock since the time of Christison, but as I have yet to find the first paper in which efforts have been made to prove that loss of sensation does not occur, but little importance can be attached to such assertions.

Action on the Circulatory System. On the Pulse.—As is shown by the following experiments, conia, in ordinary therapeutic doses, causes an increase in the number of heart beats, with a subsequent decrease, but in these doses the disease never goes below the original number of beats.

No. of experim't.	Animal.	Time.	Dose.	Pulse.
49	Man	......	.....	72
.....	.....	10.47	$\frac{1}{16}$ gr.	....
.....	.....	.50	.....	80
.....	.....	.51	.....	90
.....	.....	$\frac{1}{2}$	.....	90
.....	.....	.53	.....	80
.....	.....	.55	.....	80
.....	.....	11.00	.....	76
.....	.....	.01	.....	76
.....	.....	.03	.....	76
.....	.....	.07	.....	72
.....	.....	.09	.....	72
.....	.....	.11	.....	78
.....	.....	.15	.....	74
.....	.....	.21	.....	74
.....	.....	.27	.....	72
.....	.....	.50	.....	72

No. of experim't.	Animal.	Time.	Dose.	Pulse.
50	Man	......	.....	72
.....	.....	1.39	$\frac{1}{12}$ gr.	....
.....	.....	.40	.....	93
.....	.....	.52	.....	92
.....	.....	.56	.....	94
.....	.....	.57	.....	104
.....	.....	.58	.....	100
.....	.....	2.01	.....	98
.....	.....	.04	.....	100
.....	.....	.11	.....	90
.....	.....	.15	.....	88
.....	.....	.18	.....	88
.....	.....	.26	.....	86
.....	.....	.29	.....	80
.....	.....	.34	.....	80
.....	.....	.36	.....	86
.....	.....	.39	.....	84
.....	.....	.43	.....	84
.....	.....	.44	.....	82
.....	.....	.54	.....	72
.....	.....	.56	.....	72
51	Man	......	.....	76
.....	.....	3.14	$\frac{1}{9}$ gr.	....
.....	.....	.16	.....	84
.....	.....	.18	.....	86
.....	.....	.25	.....	88
.....	.....	.32	.....	84
.....	.....	.35	.....	88
.....	.....	.36	.....	93
.....	.....	.38	.....	97
.....	.....	.46	.....	88
.....	.....	.49	.....	92
.....	.....	.58	.....	100
.....	.....	4.00	.....	92
.....	.....	.30	.....	76
.....	.....	5.05	.....	76
52	Man	......	.....	84–88
.....	.....	1.56	$\frac{1}{7}$ gr.	....
.....	.....	2.00	.....	104
.....	.....	.01	.....	102
.....	.....	.02	.....	110
.....	.....	.03	.....	104
.....	.....	.05	.....	100
.....	.....	.06	.....	96
.....	.....	.11	.....	112
.....	.....	.12	.....	100
.....	.....	.14	.....	98
.....	.....	.17	.....	96
.....	.....	.20	.....	96
.....	.....	.21	.....	94
.....	.....	.24	.....	90
.....	.....	.26	.....	91
.....	.....	.28	.....	92
.....	.....	.30	.....	94

No. of experim't.	Animal.	Time.	Dose.	Pulse.
52	Man	2.37	.....	92
.....	.....	.39	.....	92
.....	.....	.53	.....	88
.....	.....	.54	.....	86
.....	.....	.58	.....	84
.....	.....	3.00	.....	88
.....	.....	.24	.....	86
53	Man	......	.....	81
.....	.....	1.10	$\frac{1}{6}$ gr.	....
.....	.....	.11	.....	81
.....	.....	.17	.....	87
.....	.....	.28	.....	86
.....	.....	.30	.....	88
.....	.....	.35	.....	91
.....	.....	.40	.....	92
.....	.....	.47	.....	90
.....	.....	.49	.....	90
.....	.....	2.00	.....	88
.....	.....	.04	.....	82
.....	.....	.28	.....	82
.....	.....	.35	.....	82

In poisonous, and even in full therapeutic doses, the subsequent decrease in the number of pulsations goes far below the normal number, as will be seen in the following experiments:—

No. of experim't.	Animal.	Time.	Dose.	Pulse.
54	Man	......	.....	80
.....	.....	2.25	$\frac{1}{5}$ gr.	......
.....	.....	.27	.....	80
.....	.....	.29	.....	80
.....	.....	.31	.....	80
.....	.....	.34	.....	80
.....	.....	.37	.....	80
.....	.....	.40	.....	90
.....	.....	.42	.....	89
.....	.....	.43	.....	84
.....	.....	.55	.....	84
.....	.....	.58	.....	82
.....	.....	3.00	.....	80
.....	.....	.02	.....	80
.....	.....	.03	.....	88
.....	.....	.04	.....	87
.....	.....	.07	.....	89
.....	.....	.09	.....	72
.....	.....	.11	.....	72
.....	.....	.13	.....	72
.....	.....	.16	.....	76
.....	.....	.17	.....	74

No. of experim't.	Animal.	Time.	Dose.	Pulse.
54	Man	3.18	.....	72
.....	.....	.19	.....	66
.....	.....	.20	.....	72
.....	.....	.21	.....	72
.....	.....	.25	.....	72
.....	.....	.54	.....	62
.....	.....	4.00	.....	72
.....	.....	.30	.....	80
.....	.....	.45	.....	80
55	Mouse	......	.....	120
.....	.....	12.45	1 gtt.	......
.....	.....	.46	.....	140
.....	.....	.48	.....	120
.....	.....	.50	.....	99
.....	.....	.55	.....	72
.....	.....	1.01	.....	00
56	Cat	......	.....	230
.....	.....	5.10	$\frac{3}{4}$ gtt.	......
.....	.....	.13	.....	300 (estimated)
.....	.....	.16	.....	300 "
.....	.....	.21	.....	252 "
.....	.....	.26	1 gtt.	......
.....	.....	.32	.....	312 (estimated)
.....	.....	.35	.....	240
.....	.....	.38	2 gtt.	......
.....	.....	.39	.....	252
.....	.....	.40	.....	214 (estimated)
.....	.....	.53	2 gtt.	......
.....	.....	.55	.....	(probably) 400
.....	.....	.58	.....	252
.....	.....	.59	.....	180
.....	.....	6.01	.....	120
57	Frog	......	.....	72
.....	.....	9.03	$\frac{1}{40}$ gtt.	......
.....	.....	.04½	.....	78
.....	.....	.06	.....	72
.....	.....	.07	.....	68
.....	.....	.14	.....	42

To prove whether or not the primary increase was due to some action on the pneumogastric centres, I made the following experiments:—

No. of experiment.	Animal.	Time.	Dose.	Pulse	Remarks.
58	Mouse	....	....	....	Cut both vagi.
....	....	....	....	250	....
....	....	1.56	½ gtt.	....	....
....	....	.57	....	250	....
....	....	2.00	....	250	....
....	....	.02	....	250	....
....	....	.03	....	250	....
....	....	.05	....	250	....
....	....	.08	....	225	....
....	....	.10	....	225	....
....	....	.15	....	225	....
....	....	.22	....	70	Resp's ceased.
....	....	.24½	....	24	....
....	....	.25	....	1	....

As no increase occurred after the pneumogastrics were cut, the increase in the number of pulsations in the other experiments must have been due to a depressing action on the pneumogastric centres. The subsequent diminution in the number of pulsations can readily be explained by the occurrence of paresis of the vaso-motor nerves, this latter being due to commencing paralysis of the cord.

Arterial Pressure.—Conia causes the column of mercury in the cardiometer to be decidedly lowered at first, but very soon the mercury again rises to far above its original height. The following experiment illustrates this:—

Exp. 59. On a large cat. Normal pressure, 7½ to 8 cent. met. 2.07, injected one drop of conia into the femoral vein. 2.08, arterial pressure, 7 to 7½. 2.09, arterial pressure, 8 to 8½. 2.10, pressure, 8½ to 9. 2.11, pressure, 10 to 11.

Action on the Respiratory System.—The first effect of a poisonous dose of conia is to cause an increase in the number of respiratory movements; this is followed, sooner or later, by a diminution, and ultimately, if the dose be sufficiently large, by their complete cessation.

No. of experiment.	Animal.	Time.	Dose.	Respirations per minute.	Remarks.
60	Frog	....	....	156	....
....	....	1.00	$\frac{1}{200}$ gtt.	....	....
....	....	.01½	....	252	....
....	....	.02	....	190	Paralysis.
....	....	.05	....	9	....
....	....	.07	....	0	Spinal paralysis.

No. of experiment.	Animal.	Time.	Dose.	Respirations per minute.	Remarks.
61	Frog	....	....	84	....
....	....	1.20	$\frac{1}{400}$ gtt.	....	....
....	....	½	....	126	....
....	....	.22	....	90	....
....	....	.24	....	78	....
....	....	.26	....	0	Spinal paralysis.
62	Cat	....	....	21	....
....	....	12.45	3 gtt.	....	....
....	....	½	....	61	....
....	....	.46	....	36	....
....	....	.48	....	26	Paralysis.
....	....	.57	....	8	....
....	....	1.02	....	0	Spinal paralysis.
63	Cat	....	....	112	....
....	....	5.10	¾ gtt.	....	....
....	....	.14	....	126	....
....	....	.17	....	140	....
....	....	.21	....	132	....
....	....	.25	....	150	....
....	....	½	1 gtt.	....	....
....	....	.28	....	148	....
....	....	.29	....	150	....
....	....	.35	....	108	....
....	....	.37½	2 gtt.	....	....
....	....	.38	....	228	....
....	....	.40	....	224	....
....	....	.42	....	168	....
....	....	.51	....	108	Convulsions.
....	....	.54	....	104	Convulsions.
....	....	.58	....	64	Paralysis.
....	....	.59	....	30	....
....	....	6.00	....	8	....
....	....	.01	....	2	....
....	....	.02	....	0	Spinal paralysis.
64	Frog	....	....	150	....
....	....	5.20½	$\frac{1}{200}$ gtt.	....	....
....	....	.21	....	160	....
....	....	.24	....	120	....
....	....	.27	....	16	Paralysis.
....	....	.28	....	0	Spinal paralysis.
65	Mouse	....	....	100	Vagi uncut.
....	....	4.57¼	1 gtt.	....	....
....	....	½	....	110	....
....	....	.58½	....	120	....
....	....	5.04	....	100	....
....	....	.06	....	50	Paralysis.
....	....	.06½	....	20	....
....	....	.08	....	16	....
....	....	¼	....	0	Spinal paralysis.

Pelvette and Damourette (loc. cit.) supposed that the acceleration of the respiratory movements was due to spinal excitation, in which supposition they were undoubtedly wrong, as it was shown when speaking of conia's action on the spinal cord that no excitation occurs. As the following experiment proves that the primary acceleration of the respiratory movements does not occur when both pneumogastrics have previously been divided, the acceleration is probably due to paresis of the pneumogastric centres.

No. of experiment.	Animal.	Time.	Dose.	Respirations per minute.	Remarks.
66	Mouse	....	....	....	Cut both vagi.
....	....	....	....	120	....
....	....	1.56	½ gtt.	....	....
....	....	.57	....	110	....
....	....	2.00	....	108	....
....	....	.01	....	108	....
....	....	.03	....	112	....
....	....	.05	....	104	....
....	....	.07	....	104	....
....	....	.10	....	104	....
....	....	.12	½ gtt.	....	....
....	....	.15	....	100	....
....	....	.20	....	0	....

Kölliker (loc. cit.) supposed that the diminution and the subsequent complete failure in the respiratory movements were due to the action on the peripheral ends of the efferent nerves causing paralysis of the muscles concerned in respiration, but as I prove in the following experiments that the respiratory movements continue long after the occurrence of paresis, or even paralysis, his explanation will have to be abandoned.

Exp. 67. On a large frog. 3.09, injected one-quarter drop of conia into the abdomen. 3.14, paresis over the whole body; respiration continues. 3.17, the paralysis is now complete, but respiration continued until 3.22.

Exp. 68. 5.19, injected one-half drop of conia into the abdomen of a frog. 5.24, complete paralysis, but the respiratory movements continue until 5.31.

Exp. 69. On a young cat. 12.52, injected three drops of conia into the peritoneum. 12.57, the paralysis is complete, but the respirations continue until 1.20.

Exp. 70. 2.12, injected one drop of conia into the peritoneum of a mouse. 2.15½, the paralysis is complete, but the respiratory movements continue until 2.20.

The following experiments show that the paralysis of the spinal cord and the cessation of respiratory movements occur at the same time, rendering it very probable that the latter is an effect of the former.

Exp. 71. Tied the abdominal aorta of a frog. 10.36, injected one-hundredth of a drop of conia into the abdomen. 10.39¾, the paralysis is complete anteriorly; respiration still continues, and galvanization of the spinal cord causes movements in the ligatured limbs. 10.41, respiration ceased; galvanization of the cord produces no movements.

Exp. 72. On a medium-sized cat. 1.00, injected three drops of conia into the peritoneum after tying the left femoral artery. 1.08, paralysis, but respiration continues. 1.30, respiration ceased, and galvanization of the cord causes no response.

Exp. 73. Tied the abdominal aorta of a mouse. 2.02, injected one drop of conia into the peritoneum. 2.10, respirations ceased; galvanization of the cord causes no response.

Gastro-Intestinal Action.

In ordinary medicinal doses no gastro-intestinal symptoms occur in man; in experiments upon myself grain doses were unable to produce attempts at vomiting, or even anorexia. Out of one hundred and forty-eight conia experiments made by the writer, but three cases of vomiting occurred, and these were in dogs, who, as is well known, vomit very readily.

Exp. 74. On a young dog. 8.10, gave him one-half grain of conia by the mouth; in three minutes he vomited. On the following day an injection of one-half grain into the peritoneum caused vomiting in a very short time.

Exps. 75 and 76. Vomiting occurred when conia was injected into the femoral vein.

In these experiments vomiting took place when conia was introduced through other channels than by the mouth and stomach, and they, therefore, prove that the gastro-intestinal irritation is not due to any local action on the alimentary canal, as is claimed by Harley (loc. cit. p. 82): it must be the result, as in the case of opium, of a specific action on the gastro-intestinal apparatus.

These symptoms are not exclusively canine, but they also occur in man, as attempts at vomiting are recorded by Bennet (Ed. Journ. Med. Sci. 1845) in case of poisoning by hemlock leaves, and Schroff (Vierteljahrschr. f. Praktische Heilkunde, 1855), in his experiments with conia on the human subject, records one case in which there was actual vomiting.

Action on the Glandular System.

One of the first effects of a very large therapeutic dose of conia, in about one-half of the writer's experiments, was to increase the secretion of the salivary glands. This increase is not due to any local action, as it occurs when the drug is injected into a vein or into the peritoneum.

As regards the drug's effect on the urinary secretion, my experiments compel me to endorse the conclusion of Verigo (loc. cit.), who asserts that "conia has no influence on the quantity or quality of the urine." Casanbau (loc. cit.), however, believes that in the beginning the secretion of the kidneys, like that of the salivary glands, is increased. Probably this investigator was misled through the fact that the animals voided their urine soon after a large dose of the drug was administered, but this urination is due to the spasmodic contractions of the muscular fibres of the bladder, which almost always occurs.

I have never observed any action on the skin, as evinced by either an increase or a decrease in the amount of perspiration, and, as other investigators are silent on this point, it is very probable that its function remains unaffected.

Conia's action on the biliary secretion has not yet been determined, but the circumstance, first noticed by Nega (Zeitschr. f. Klin. Med. Breslau; 1850, 1), and confirmed by Van Praag (loc. cit.), that after death from conia-poisoning, the gall-bladder is always found distended with bile, renders it probable that it increases the biliary secretion. In all the *post-mortem* examinations made by the writer on animals poisoned by conia, this distension of the gall-bladder was invariably present.

Action on the Muscular System.

The voluntary muscles escape unscathed in conia-poisoning, they continuing to respond to galvanism for a long time after death. The contractility of the muscles, however, may be destroyed by soaking in a very concentrated solution of the alkaloid, but before such an effect can be produced in life, the animal will have perished.

On the non-striated muscular fibres the action of the drug is more pronounced; Geiger (Mag. f. Pharm. xxxv. S. 72 u. 256), states that it produces irritation of the involuntary muscular fibres of the diaphragm and alimentary canal. In the experiments made by the writer, contractions of the muscular fibres of the intestinal canal and bladder were observed.

Action on the Pupil.

Dr. Hoppe (Die Nervenwirkung d. Heilmittel, Leipsic, Hft. 1). made a number of experiments to determine this action of the drug, and in conclusion says: In the beginning the pupil is contracted, but later it becomes very much dilated. His conclusion has been confirmed by Pelvette and Demourette (loc. cit.), who attribute the contraction to augmentation of the excitability of the spinal cord.

The conclusions drawn by the writer from a number of experiments made especially to determine this point, are as follows: When conia is introduced hypodermically, or given by the stomach, the pupil never contracts, but sooner or later it always dilates, this dilatation being due to the paresis of the peripheral extremities of the ciliary branches of the motor-oculi nerve, no longer enabling the sphincter of the iris to counteract the radiating fibres supplied by filaments from the more slowly paralyzing sympathetic nerve. When locally applied conia at first contracts and then dilates the pupil, the dilatation occurring from the absorption of the drug. As the contraction did not occur when conia was introduced hypodermically or given by the stomach, it must be due to its local irritant action, and not to augmentation of the excitability of the spinal cord.

Action on Temperature.

All investigators of the action of conia have thus far agreed on one point, to almost totally ignore this action of the drug. One copying from the other, all saying that the temperature is lowered, and, as far as I am aware, until this investigation, no one even imagined that conia was so peculiar as to be one of three drugs (atropia, woorara,(?) and conia) that cause a decided increase in the temperature of the animals poisoned. This increase occurs not only from poisonous doses, but also when full therapeutic doses are administered. This increase in temparature lasts from three-quarters of an hour to an hour and a half, when the temperature gradually becomes normal.

No of experim't.	Animal.	Time.	Dose.	Temperature.
77	Cat	......	.....	99¾°
.....	.....	5.10	¾ gtt.	......
.....	.....	.15	.....	101
.....	.....	.17	.....	100½
.....	.....	.23	.....	100
78	Man	......	.....	97½
.....	.....	3.14½	1/9 gr.	......
.....	.....	.21	.....	97½
.....	.....	.30	.....	98¾
.....	.....	.45	.....	98¾
.....	.....	4.00	.....	98½
.....	.....	.36	.....	98⅓
.....	.....	5.19	.....	97½
79	Man	......	.....	97
.....	.....	1.56	1/7 gr.	......
.....	.....	.59	.....	97
.....	.....	2.09	.....	98½
.....	.....	.17	.....	98¾
.....	.....	.19	.....	99
.....	.....	.22	.....	99⅙
.....	.....	.24	.....	99¼
.....	.....	.28	.....	99½
.....	.....	.32	.....	99½
.....	.....	.30	.....	99½
.....	.....	3.24	.....	97½
80	Man	......	.....	97
.....	.....	1.10	⅙ gr.	......
.....	.....	.24	.....	98½
.....	.....	.33	.....	99
.....	.....	.50	.....	98⅛
.....	.....	2.28	.....	97½

No. of experim't	Animal.	Time.	Dose.	Temperature.
81	Man	......	.....	$96\frac{1}{3}$
.....	.....	4.40	$\frac{1}{6}$ gr.	......
.....	.....	.54	.....	$97\frac{1}{2}$
.....	.....	5.20	.....	$97\frac{1}{2}$
.....	.....	.35	.....	$97\frac{1}{2}$
.....	.....	.56	.....	$98\frac{1}{3}$
.....	.....	6.25	.....	$97\frac{1}{2}$
.....	.....	.55	.....	$96\frac{1}{2}$
82	Man	......	.....	$98\frac{1}{2}$
.....	.....	1.39	$\frac{1}{12}$ gr.	......
.....	.....	.44	.....	$98\frac{1}{2}$
.....	.....	2.07	.....	99
.....	.....	.15	.....	99
.....	.....	.31	.....	$98\frac{1}{2}$

Action on the Sexual Organs.

The genital depression attributed to conium by the ancients, modern investigators have been unable to discover. The ancients believed, that not only does it repress sexual desire, but that it actually caused an atrophy of the testes and mammæ, which latter, of course, implies atrophy of the ovaries also. The falsity of this belief was shown in several cases of chorea, occurring in girls about the age of puberty, in whom menstruation came on while the patients were under the physiological effects of conia. That it has no effect on the mammary secretion of cats is proved by the following experiment.

Exp. 83. A four-year-old cat was delivered of kittens on July 20th. On the evening of the same day she was given one drop of conia by the stomach, and on the next morning another drop was given, with the following result: great difficulty in moving and respiring, without any apparent effect on the mammary secretion, the kittens sucking freely. On the morning of the 22d, another drop was given, and, until the 29th, the animal was given a drop daily without any noticeable effect on the quantity or quality of the milk; the kittens continuing very healthy, but in all of them some of the physiological effects of the poison being at times manifest.

In order to determine, whether or not conia, in non-poisonous doses, has the power to arrest or depress natural sexual desire, an experiment was made on a large tom cat, who is in the habit of enlivening our dreams by midnight concerts in the backyard. He was given one-twentieth of a grain of conia on four consecutive nights. Finding that this dose produced no effect, on the fifth night I gave him two drops hypodermically, yet that night, though very much under the influence of the drug, he, after many failures, managed to creep to his trysting place and commenced his regular nocturnal music. This experiment proves beyond a doubt that conia has no power to arrest or depress natural sexual desire; but while this is the case in the normal condition, morbid states are said to be much influenced by the drug. In proof of this, Dr. Harley (loc. cit. p. 51) writes: "In those states of exhaustion and irritability which arise from self-abuse; and in those cases of erotic tendency that arise from some obscure irritation of the lumbar portion of the cord, I have never known conium to fail to give relief." In my opinion, however, this relief is better explained by referring it to the depressant action which the drug has on the spinal cord, than to any possible action on the sexual organs.

Absorption and Elimination.

That conia is absorbed is beyond question, as it has been found by Orfila in the spleen, kidneys, and lungs of poisoned animals. Absorption occurs without regard to the manner in which the drug is introduced into the system, but when the drug is placed on the whole skin in small quantities, absorption does not take place. That this must be due to its great volatility is shown by the following experiment.

Exp. 85. Placed thirteen very small frogs in a weak solution of conia at 4.31; took them out in one-half minute. 4.35, four of the frogs are paralyzed. At 4.37, three more were paralyzed, and by 4.40, all were paralyzed.

Absorption must have taken place through the skin of these animals, as the solution merely reached up to their abdomen.

Conia undergoes no change in the system, although Harley says it does, because he failed to find it in the urine of poisoned animals; yet it is eliminated by the kidneys, in whose secretion Zaleski and Draggendorf (H. C. Wood's Therapeutics) have found abundance of it in the first twelve hours of the poisoning, and traces of it for two days and a half.

That it is not necessary for conia to be changed in the system in order to produce its most marked effect, that on the periphery of the efferent or motor nerves, was proved by the following experiment.

Exp. 86. Cut off both hind legs of a cat previously killed with chloroform; both sciatics respond equally well to galvanism. Into the left femoral artery a one-grain solution of conia, while into the right an equal quantity of water was injected. In thirty seconds the application of the galvanic current to the left sciatic nerve causes no response, while its application to the right sciatic causes contraction in its tributary muscles.

The following physiological test proves, conclusively, that conia is eliminated by the urine.

Exp. 87. Placed two small frogs in the urine of a coniinized animal; in forty seconds they were both taken out completely paralyzed.

Exp. 88. Placed two small frogs in the urine of another coniinized animal, and obtained results similar to those obtained in the last experiment.

As the conclusions at which I have arrived are scattered throughout the essay, it has been thought proper at this point to present a concise summary of the conclusions previously given.

I. Conia, instead of being poisonous to plants, as has heretofore been supposed, really acts as a preservative; the alcoholic extract of hemlock, however (probably through some impurities which it contains, but, above all, not through the action of conia, which it rarely contains), acts poisonously on plants.

II. When locally applied, conia produces a progressive loss of functional power in every highly organized tissue with which it comes in contact. If such contact be not continued too long, the tissue may recover, even after a total suppression of its function.

III. In inducing complete repose of the muscular system, conia powerfully predisposes to sleep, but it is not a hypnotic in the sense that opium is.

IV. The convulsions produced by a poisonous dose of hemlock are cerebral, and not spinal, as has heretofore been imagined.

V. Conia produces a double effect on the motor-nervous system, —a paralyzing effect on the periphery of the efferent or motor nerves, and a depression of the motor tracts of the spinal cord. In almost all the experiments the former occurred first and predominated, the paralysis of the cord not occurring until the period of death, but in two experiments the peripheral paralysis failed to occur, while the spinal paralysis was manifest much earlier.

VI. The increase in the number of heart beats which occurs early in conia-poisoning, is due to paresis of the pneumogastrics; the subsequent decrease is due to paresis of the vaso-motor nerves, this paresis being due to commencing paralysis of the motor tract of the spinal cord.

VII. The primary acceleration in the respiratory movements is also due to pneumogastric paresis, while their diminution, which soon occurs, is caused by, and proceeds *pari passu* with the paresis of the spinal motor tract.

VIII. The salivary secretion is the only secretion markedly increased by a poisonous dose of conia.

IX. The voluntary muscles escape unscathed in conia-poisoning; their contractility, however, may be destroyed by soaking in a concentrated solution of the alkaloid. Contractions of the non-striated muscular fibres of the alimentary canal and bladder are caused by poisonous doses.

X. Contraction of the pupil only occurs when the drug is directly applied to the eyeball; it is then due to irritation. The dilatation of the pupil occurring after the absorption of conia is due to paresis of the peripheral extremities of the ciliary branches of motor-oculi nerves, no longer enabling the sphincter of the iris to counteract the radiating fibres supplied by the more slowly paralyzing sympathetic nerve.

XI. Conia, unlike almost every other drug of the materia medica, and contrary to the statement found in all works on therapeutics, causes a decided increase in temperature.

XII. The genital depression attributed to conium by the ancients must have depended entirely on their imaginations, and not on atrophy of the testes and mammæ.

XIII. Conia is absorbed and is eliminated unchanged by the kidneys.

SEPTEMBER 7.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-one members present.

On Mermis acuminata.—Prof. LEIDY exhibited a living specimen of *Mermis acuminata*, which had been sent to him for examination, the 8th of last August, by Mr. P. H. Foster, of Babylon, Long Island, N. Y. It was one of two specimens which Mr. Foster had taken from apple worms found concealed in a woollen rag tied around the trunk of an apple tree in his garden. The Mermis is 7½ inches long, and had been retained alive in a box with moist sphagnum. It exhibits a condition which Prof. L. had observed on several previous occasions in other species of Mermis. An intermediate portion of the body, apparently from injury, had died and was decomposed, while the extremities held together by the integument were still alive and active. This condition has been observed to be maintained for some time, that is to say, for some weeks.

SEPTEMBER 14.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-six members present.

SEPTEMBER 21.

Dr. CARSON, Vice-President, in the chair.

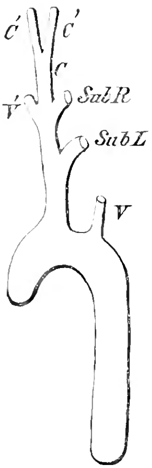
Forty-nine members present.

Variations in the Stipular Spines of Robinia Pseud-acacia.—Mr. THOMAS MEEHAN referred to the thorns of the yellow locust, which, as usually seen, were about a quarter of an inch long, and nearly as wide at the base; triangular in shape. At the meeting of the American Association at Detroit he collected specimens, one of which he exhibited, with slender spines, about three-quarters of an inch long. Since then, in the vicinity of Chicago, he had noticed that there was considerable variation in the direction of long and slender spines. In his own vicinity he had since noted a large number of trees, and some variation, but only to-day had he found one with long, slender spines, and that was even longer than the case from Detroit, being in some cases a full inch in length. The fact of this great variation was probably new;

but it was also interesting from its bearing on a physiological question of importance. The first suggestion made by most of his botanical friends, to whom he had mentioned these facts, and he believed the first that would occur to the minds of most botanists, would be that these extra strong spines would be found in connection with extra strong shoots. If these were true spines—that is to say, abortive branches—the inference would be a fair one; but these thorns were the analogues of stipules, as we look for in allied leguminous plants, and would, therefore, be most likely to follow the laws which influenced stipular productions. One of those laws was, at least so far as his own observation went, that stipular development was in inverse ratio to ordinary growth force. For instance, we say that the scales which cover the buds of trees in winter are metamorphosed leaves; but this is, in many cases, certainly not strictly true. Bud scales are, in many cases, but modified stipules where leaves have these appendages, and dilated petioles where they have not. This peculiar development of the stipules, of course, only commences with the decline of growth force in the axis in the fall, or before it has achieved great power in the spring.

The specimens of *Robinia* exhibited illustrated the same law. In the one from Detroit—the three-quarter inch slender stipular spines—it would be seen by the members, were not from a very vigorous branch, but from a very slender one; but the best illustration was on the strong branch which he exhibited, cut to-day, and with the inch spines before referred to. This was from the upper portion of a branch of this year's growth, 6 feet long. On the lower portion of the part exhibited, produced when the growth force would be at its maximum, the spines are of the normal size, about one-quarter of an inch in length; and these spines increase in length gradually to an inch in proportion as the season's growth becomes weaker. But there is a still stronger illustration in the secondary branchlets which have grown from the main one. These are no thicker than straws, but the spines are about three-quarters of an inch in length, and slender, and much larger, in comparison with the axis to which they are attached, than the largest on the strong main branch.

On the Anatomy of the Giraffe.—Dr. H. C. Chapman remarked that, although the anatomy of the giraffe has been well described in the Phil. Trans. by Prof. Owen, as the opportunity of dissecting it does not occur often, and the literature of the subject is not very full, it does not appear superfluous to call attention to one or two facts noticed in a dissection of the male animal that died some time since in the Zoölogical Garden, and whose stuffed skin makes a valuable addition in our museum. He had pleasure in saying that he found the internal organs as described by Prof. Owen, save in reference to the manner in which the great bloodvessels



spring from the aorta. In the example dissected by Dr. Chapman, there was an innominate artery, which gave off the left subclavian, *sub L.*, the right subclavian, *sub R.*, the right vertebral, *V′*, and the common trunk of the carotids, *C*; the left vertebral, *V*, springing alone from the aorta; whereas in Prof. Owen's example, according to the description, the left subclavian, as well as the left vertebral, came off separately from the aorta, while the right vertebral came from right subclavian. It is possible that in the former the disposition of the bloodvessels was an anomalous one. He would also mention that there was an entire absence of a gall-bladder, which was noticed twice out of three times in the cases studied by Prof. Owen. For the reason above given, he did not refer to the brain, alimentary canal, etc.; to those who may be interested, he would simply state that these organs may be seen in the museum of the University of Pennsylvania.

Post-mortem Examination of an Elephant.—Dr. Chapman remarked that, while the organization of the elephant is pretty well known to naturalists, as the opportunity of dissecting it does not often present itself, he would call the attention of the members to a few points noted in his *post-mortem* of the Empress, which recently died at the Zoölogical Garden. On account of the heat of the weather, the examination was necessarily a limited one. For some months before death the animal had been gradually failing, having reached an extreme old age. Numerous abscesses in the skin (rendering it useless for stuffing) had been a continuous source of irritation; while the trouble exhibited by the generative organs was seen to result from fibro-osteoid tumors, which involved the uterus, ovaries, broad ligaments, etc. These tumors, of which there were as many as 25, varied very much in size, the smallest having the diameter of an orange, while the largest would not go into a horse bucket. The remaining organs were healthy—the heart was enormous—the aorta and pulmonary arteries looking like hose plugs. As regards the stomach, the cardiac portion was much developed, and the peculiar transverse ridges were observed. The greater curvature of the stomach measured 65 in.; the circumference in its greatest part 54 in. At the entrance of the œsophagus into stomach, in the specimen now preserved in the museum of the University of Pennsylvania, may be seen a valve extending half way across the aperture. The circumference of the small intestine was 14 in., while that of the large measured 41 in. The colon was thrown into deep folds. The liver was bilobed—but there was no gall-bladder. The kidneys exhibited the lobulated type of structure. The great omentum might be compared to a large sheet—in it the lymphatics were most beautifully exhibited. The trunk was seen to consist of longitudinal and transverse muscles, while the nerves supplying it were numerous and large.

SEPTEMBER 28.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-four members present.

Samuel G. Lewis, Eugene Santee, M.D., and Stephen Greene were elected members.

The Committee to which it had been referred recommended the following paper to be published:—

ON FOSSIL REMAINS OF REPTILIA AND FISHES FROM ILLINOIS.

BY E. D. COPE.

John Collett, the accomplished assistant of Prof. Cox of the Geological Survey of Indiana, recently submitted to my examination a number of vertebrate remains from some point in Illinois. The specimens were taken from a blackish shale, and consist of separate vertebræ and other elements of the skeleton, often in a fragmentary condition. Although the absence of information as to the mutual relations of the pieces renders the identification difficult, yet the interest attaching to them, in consequence of their peculiar forms and the locality of their discovery, renders it important to determine their zoölogical position. Mr. Collett informs me that all the specimens were found near together, and at the same horizon, by Dr. Winslow. Much credit is due to Dr. Winslow for the painstaking labor bestowed in procuring and cleaning the specimens, and for his liberality in presenting them to the geological collection.

A remarkable peculiarity of all the vertebræ of the series is the longitudinal axial perforation of the centrum. They present the character observed in *Archegosaurus* and other Stegocephalous *Batrachia;* but which also exists, according to Günther, in the living Rhynchocephalous lizard—the *Sphenodon* of New Zealand. The bones of the limbs and scapular arches are so decidedly reptilian, and so unlike those of any *Batrachia* with which we are yet acquainted, that I am disposed to refer them to the former class. And as there are several points in which the fossils resemble the order *Rhynchocephalia*, I refer them provisionally to that neighborhood. They constitute the first definite indication of the existence of animals of that type in the western hemisphere.

Associated with these saurians were found teeth of two species of fishes, which are important in evidence of the position of the beds in which they occur. One of these is a new species of *Ceratodus*, Agass., and the other a *Diplodus*. The former genus is characteristic of the Triassic period in Europe, one species having been found in the Oolite. It still lives in North Australia. In both these respects the Rhynchocephalian lizards present a remarkable coincidence. They also belong to the horizon of the

Trias in Europe, and the only living species is found in New Zealand. Thus it would seem that a fragment of this fauna, so ancient in the northern hemisphere and so remarkably preserved in the southern, has been brought to light in Illinois. It must be added, in reference to the geologic age of the fossils, that the genus *Diplodus*, Ag., has not yet been discovered above the carboniferous; and that one genus of the *Rhynchocephalia* belongs to the Permian in Germany. We, therefore, await further material before venturing a decision whether they belong to Triassic or Permian time.

Cricotus heleroclitus, Cope.

Generic characters.—This genus is indicated primarily by caudal vertebræ; other parts of the skeleton found with it probably belong to the same animal, so I describe them in this connection, awaiting further discoveries to confirm or disprove such reference. The pieces include parts of two femora—of ? tibia, ? ulna, metapodial and phalangeal bones, ribs, and other pieces.

The caudal vertebra best preserved is stout, discoidal in form, and deeper than wide. It resembles in form that of an herbivorous dinosaurian, but differs otherwise. The articular faces are deeply concave, the posterior most strongly so; and the middle is occupied by a large foramen, whose diameter is about equal to that of the centrum on each side of it. The lateral borders of the posterior articular face are expanded backwards, and articulate with a bevel of the corresponding edge of the anterior articular extremity. In this way the vertebra combines the mechanical relations of the biconcave with the opisthocoelian structures. The neural arches are narrow, and directed backwards; their bases are firmly coössified with the centrum; no zygapophyses appear on the portion of the neurapophyses preserved, and it is probable that they were weak if existing. On the inferior surface of the centrum two shallow pits occupy considerable space, and indicate the existence of large, free, chevron bones. No transverse processes. In one vertebra the floor of the neural arch is deeply excavated; in the other it is plane, and marked with a median groove.

Of the remaining bones it may be observed that the articular faces were evidently capped by cartilage, and do not present the smooth condyloid character common to so many reptiles. They are, indeed, not so smooth as the dense layer of the shafts and surrounding portions, which rises in a fine bounding ridge round the surface formerly capped by the cartilage. The articular end of a bone may be the proximal end of the femur. The section of the shaft resembles that of a T-rail—the lesser expansion representing the base of the trochanter, and the greater that of the head. Seen proximally, the head is transverse and truncate, as in the great trochanter of many mammals, while the trochanter is smaller, oval in section, and oblique to the head. There are two articular facets on the head—the larger extends across the inner side; the smaller is subround, and is directed inwards or towards the trochanter; the two are separated by the ridge of a right angle.

A supposed distal end of a metapodial bone displays a shallow trochlear face of not much antero-posterior diameter. A phalange is of remarkable form, resembling that of an herbivorous dinosaur in its short wide proportions. The articular faces are slightly trochlear in their character, and the inferior is directed inferiorly at an angle of 45° to the axis of the shaft. The form indicates a digitigrade terrestrial form. The proximal end of a rib exhibits the section of the shaft and the head. The latter has a broad, tubercular, articular surface, and a smaller capitular surface on the narrow produced head. The section of the shaft is lenticular.

This genus appears to combine some dinosaurian characteristics with those in which it resembles the *Rhynchocephalia*. This association of diverse features is confirmed by those observed in the genus *Clepsydrops*, Cope, described below.

Specific Characters.—The surface of the sides of the centrum is marked with a few coarse shallow longitudinal grooves, which run into shallow reticulations of weak raised lines. The neurapophysis is sharp-edged in front, and with some ridges externally at the base.

The edge of the posterior articular face is excavated opposite to the chevron facets. The latter are large, are separated by a flat surface, and are bordered externally by a raised edge from the polished dense layer of the lateral face.

	M.
Diameter of centrum—vertical	.021
" " transverse	.019
" " longitudinal	.011
Width of neural canal	.006
" of neurapophysis	.004

The superficial layer of the other bones is smooth or striate and rugose near articular extremities. The distal end of the head is oblique, and the side below it concave for a short distance. The very short shaft of the phalange is concave, almost emarginate on one margin. The borders of the tubercular head of the rib are thin and broadly flared outwards at the sides.

	M.
Transverse proximal diameter femur	.024
Antero-posterior diameter head of femur	.018
Transverse diameter shaft of femur	.015
Vertical diameter shaft of rib	.008
" " rib at tubercle	.016
" " rib at head	.006
Transverse diameter tubercle of rib	.008
Proximal width of phalange	.014
" depth of "	.007
Length of same phalange	.010

The remains indicate an animal more robust than any existing lizard, but probably not so long as some of the larger *Varani.*

Clepsydrops collettii, Cope.

Generic characters.—This genus reposes on a series of vertebræ, which includes cervicals, dorsals, and caudals. Associated with these are proximal ends of ribs, a coracoid bone, and some phalanges, which are provisionally referred to the same. They bear the same relation of size to the vertebræ that the corresponding bones do to the vertebræ of the *Cricotus heteroclitus*, and have an appropriately more slender form, like the vertebræ in *Clepsydrops.* They belong in any case to an allied form.

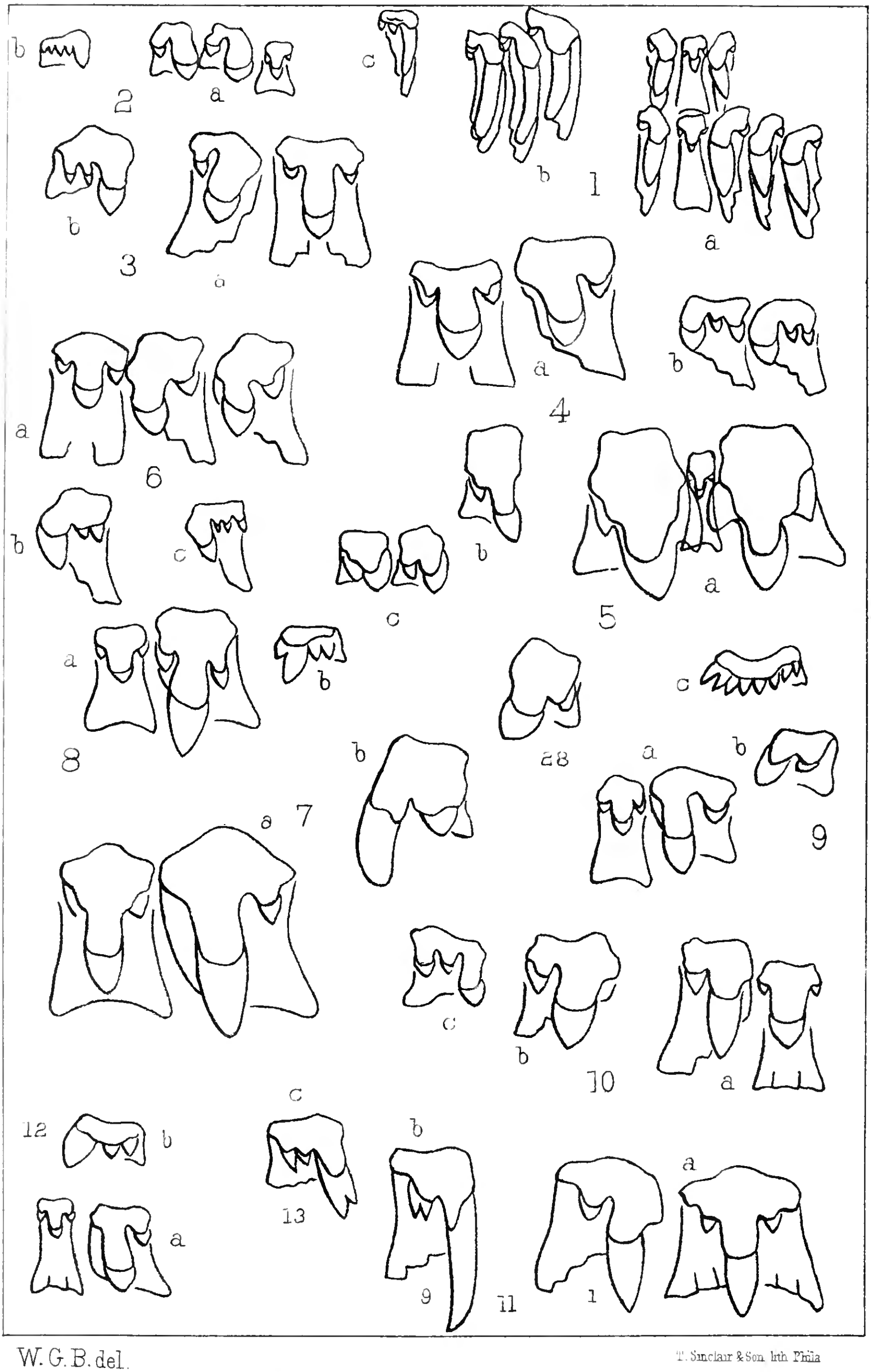
The vertebræ on which the genus reposes are more elongate than the corresponding ones of *Cricotus.* They are deeply biconcave, the articular cavities being funnel-shaped and continuous, thus perforating the entire length of the centrum. In a dorsal vertebra the cavities communicate by a very small orifice, while in the posterior, the median contraction of the canal is less marked. The posterior cavity is more gradually contracted than the anterior; in the latter the excavation is, in most of the vertebræ, but slight (except beneath the floor of the neural arch), until it falls rather abruptly into the axial perforation. In an ?anterior dorsal it is as widely excavated at the border as the posterior funnel. Another peculiarity is the absence of processes of the centrum;

and a small capitular articulation is seen sessile on the border of the cup of two of the dorsals.

The axis has a singular form, owing to the tubular perforation which continues the posterior excavation to the anterior face of the centrum. There are three articular faces, a larger subround inferior and two smaller superior, which border the neural canal in front and below, and are separated from each other and the inferior face by the perforation in question. The anterior face slopes obliquely backwards and downwards, and is convex in transverse section. There is no facet for the free hypapophysis of the odontoid, but it appears that the inferior articular face was applied exclusively to the centrum of the atlas, as in *Sphenodon*. But the axis differs from that of the latter genus in the absence of a coössified odontoid process. Either that element is altogether wanting, or it consists of two pieces, interrupted in the middle by the notochordal foramen, and in correspondence with the superior articular facets. There is no true hypapophysis of the axis, and the only indication of lateral processes is a small articular facet on each side on the lower part of the rim of the posterior funnel. These may have been related to rudimental cervical ribs. The neural arch is broken off.

The dorsal vertebræ have their sides somewhat contracted; in one specimen the inferior face is rounded, in another, which I suppose to belong to a different part of the column, it is longitudinally acute. In this and another dorsal, where the parts are exposed, the floor of the neural canal is interrupted by a deep fissure, which has a triangular shape with the apex downward, when seen in profile. This is due to the fact that the opposite halves of the centrum are united by the circumferences of the articular cups, which have in profile an ⋈ shape. The diapophysis does not project far beyond the base of the neural arch, and is compressed.

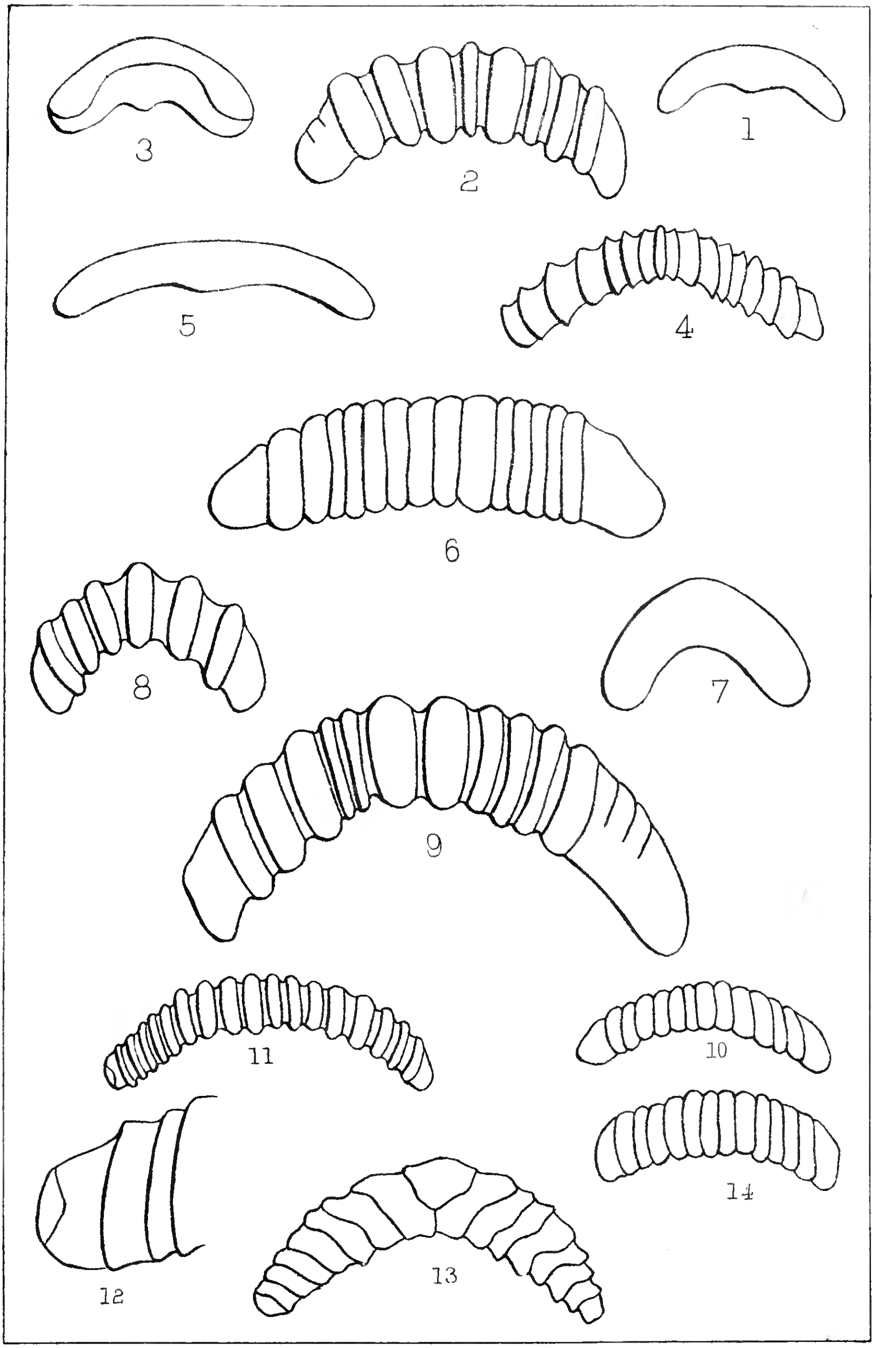
The caudals are elongate, and resemble, in the forms of the centrum and neural arch, those of *Laelaps*. The neural spines are not preserved, but if present were directed well backwards, bearing the posterior zygapophyses, since the arch stands only on the anterior three-fifths of the centrum. Chevron facets are not distinct, but two emarginations on the rim of the posterior face of one of the vertebræ indicates their existence. In other centra, even these notches are wanting. The tail was evidently tapering.



W. G. B. del.

T. Sinclair & Son lith Phila

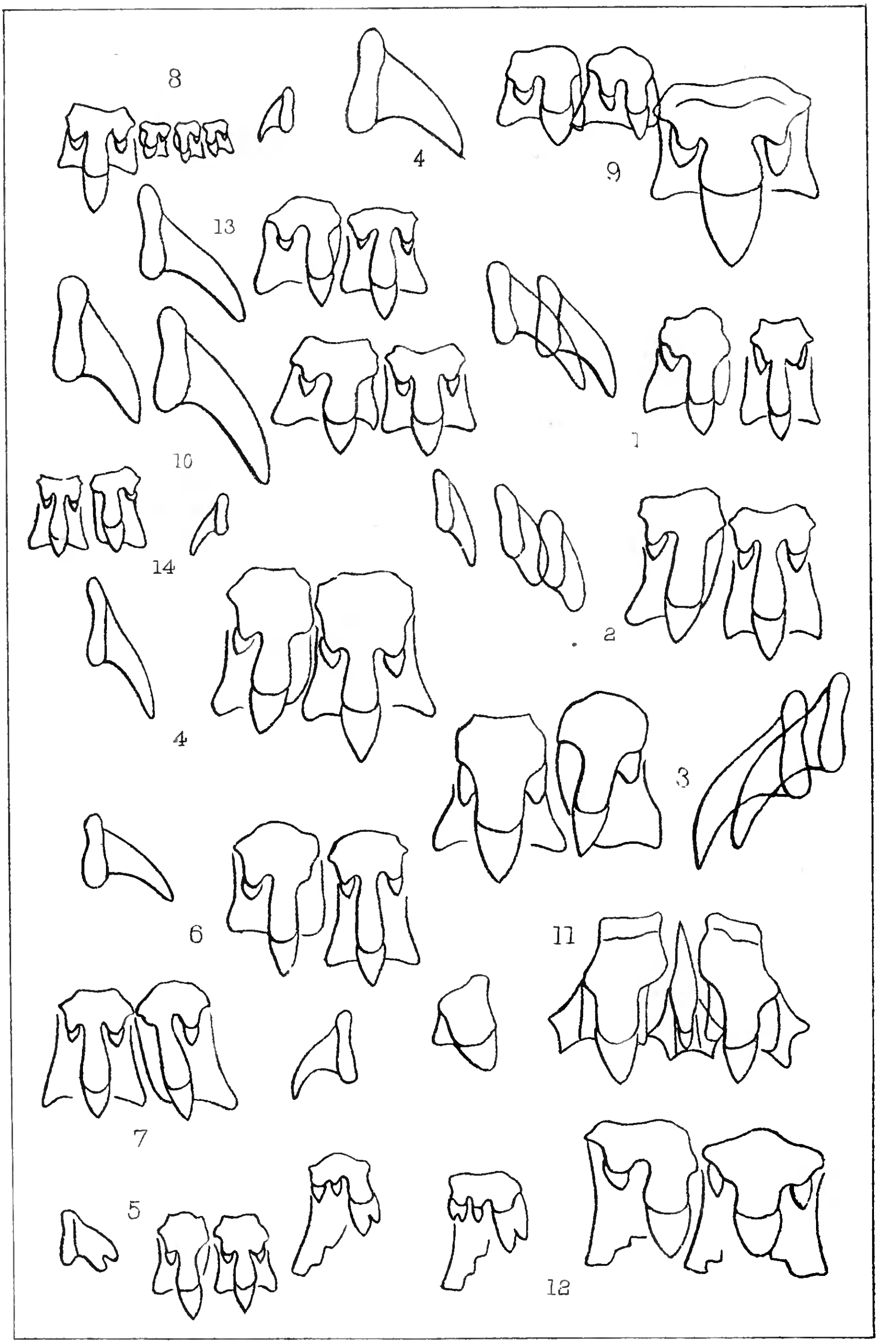
1. Macroceramus Gossei, *Pf.*
2. Pupa rupicola, *Say.*
3. Succinea avara, *Say.*
4. Succinea obliqua, *Say.*
5. Stenogyra decollata, *L.*
6. Succinea effusa, *Shuttl.*
7. Bulimus dealbatus, *Say.*
8. Stenogyra subula, *Pfr.*
9. Cœcilianella subcylindrica, *Lin.*
10. Succinea campestris, *Say.*
11. Succinea lineata, *W. G. B.*
12. Pupa fallax, *Say.*



W. G. B. del.

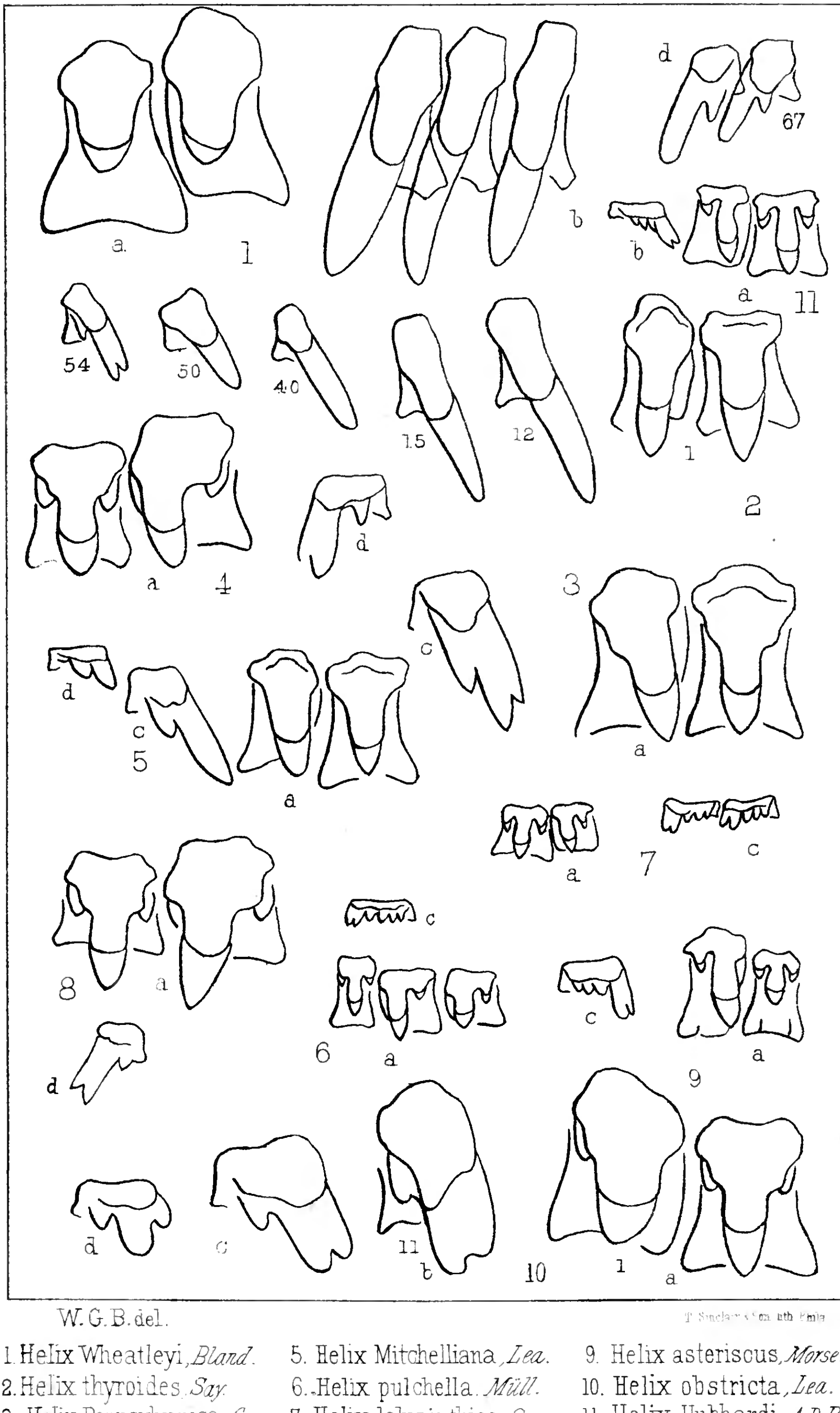
T. Sinclair & Son, lith. Phila.

1. Stenogyra subula, *Pfr.*
2. Arion hortensis, *Fer.*
3. Vitrina limpida, *Gld.*
4. Helix Newberryana, *W.G.B.*
5. Ferussacia subcylindrica, *C.*
6. Hemphillia glandulosa, *Bl. & Binn.*
7. Pupa rupicola, *Say.*
8. Helix aspersa, *Müll.*
9. Prophysaon Hemphilli, *Bl. & Binn.*
10. Helix Yatesi, *J.G. Coop.*
11. Helix polygyrella, *Bl. & J.G. Coop.*
12. Bulimulus sufflatus, *Gld.*
13. Orthalicus undatus, *Brug.*
14. Helix griseola, *Pfr.*



W. G. B. del. T. Sinclair & Son lith. Phila.

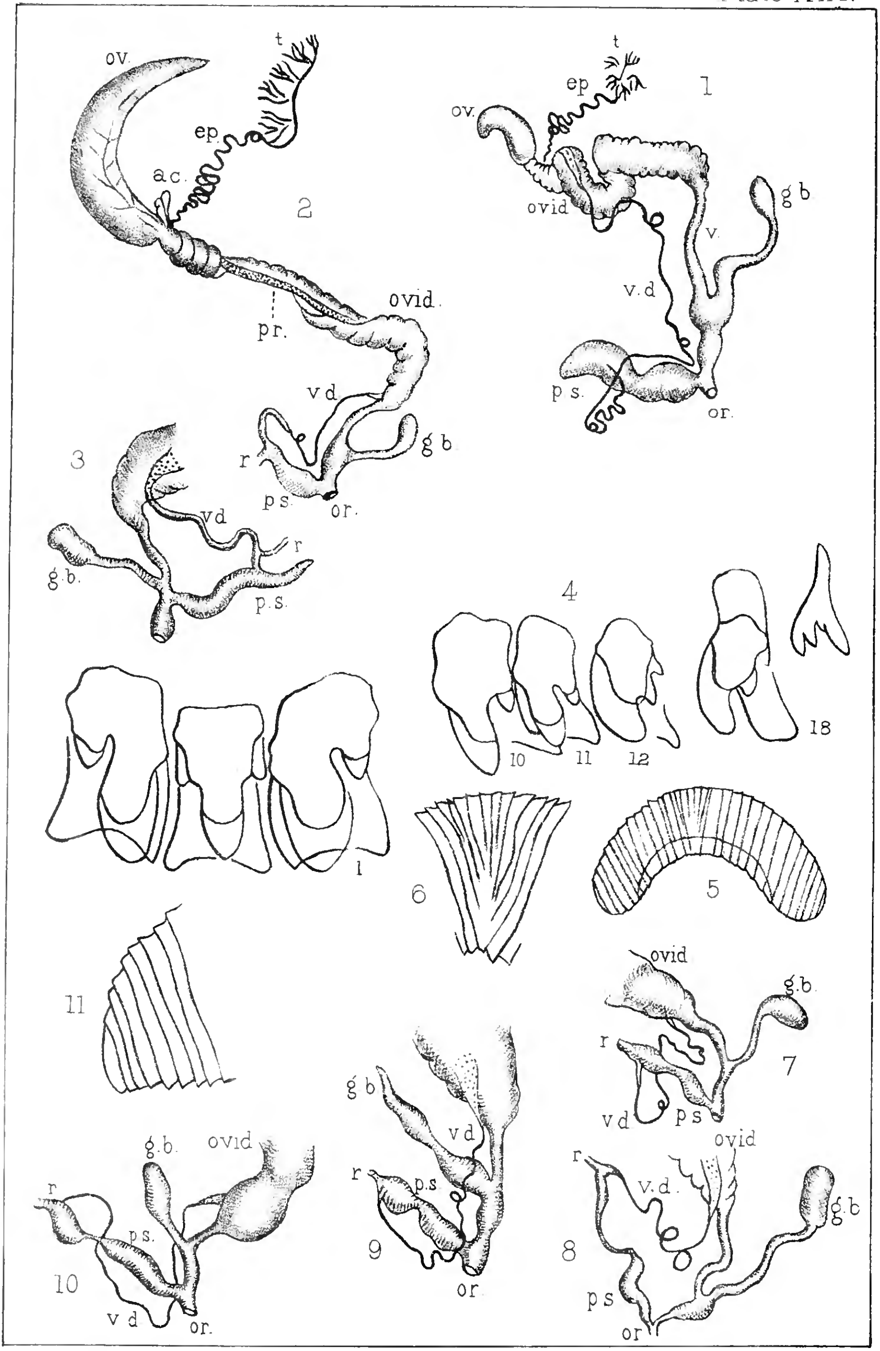
1. Zonites multidentatus, *Binn.*
2. Zonites suppressus, *Say.*
3. Zonites indentatus, *Say.*
4. Zonites arboreus, *Say.*
5. Zonites fulvus, *Drap.*
6. Zonites viridulus, *Mke.*
7. Zonites nitidus, *Müll.*
8. Zonites milium, *Morse.*
9. Zonites ferreus, *Morse.*
10. Zonites significans, *Bland.*
11. Veronicella Floridana, *Binn.*
12. Succinea Sillimani, *Bland.*
13. Zonites Binneyanus, *Morse.*
14. Zonites exiguus, *St.*



W. G. B. del.

T. Sinclair's Son lith Phila

1. Helix Wheatleyi, *Bland.*
2. Helix thyroides, *Say.*
3. Helix Pennsylvanica, *Green.*
4. Helix loricata, *Gld.*
5. Helix Mitchelliana, *Lea.*
6. Helix pulchella, *Müll.*
7. Helix labyrinthica, *Say.*
8. Helix Townsendiana, *Lea.*
9. Helix asteriscus, *Morse.*
10. Helix obstricta, *Lea.*
11. Helix Hubbardi, *A. D. Br.*



W. G. B. del.

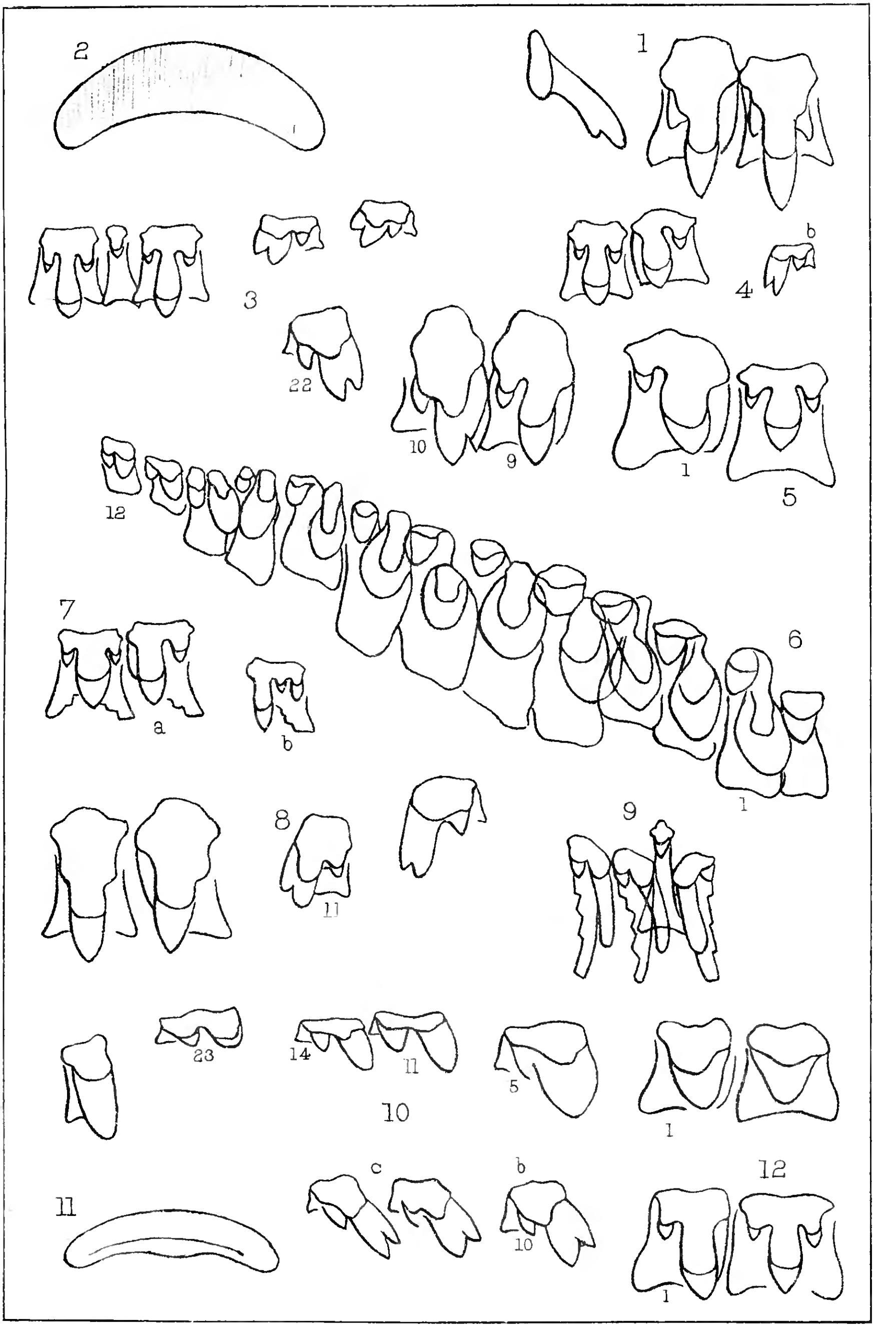
T. Sinclair & Son, lith. Phila.

1. Partula. 5. Partula. 9. P. fusca, *Pse.*

2. H. sagemon, *Blk.* 6. P. gracilis, *Pse.* 10. P. bilineata *Pse.*

3. H. auricoma, *Fer.* 7. P. umbilicata, *Pse.* 11. P. virginea, *Pse.*

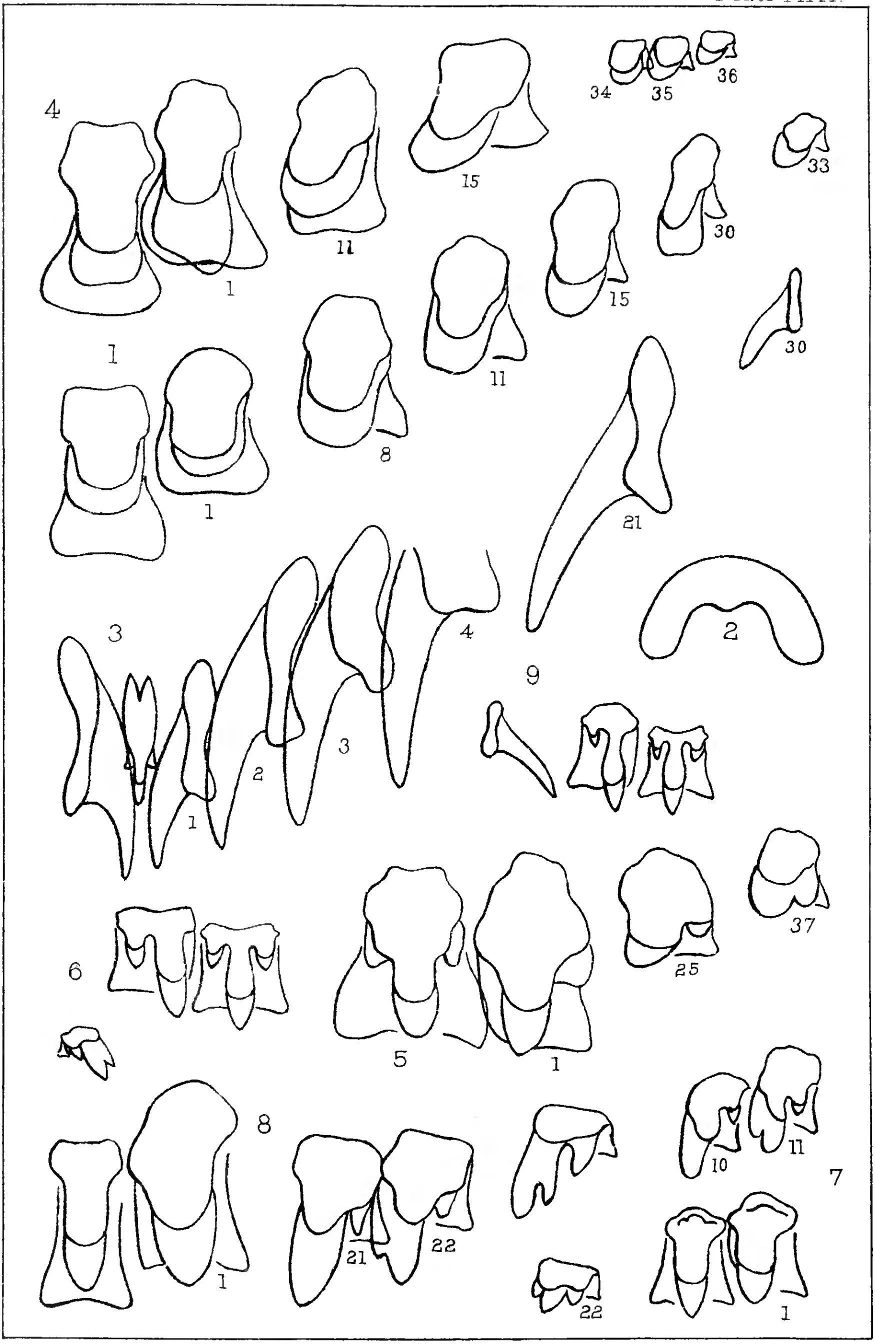
4. P. amanda, *Pse.* 8. P. virginea, *Pse.*



W. G. B. del.

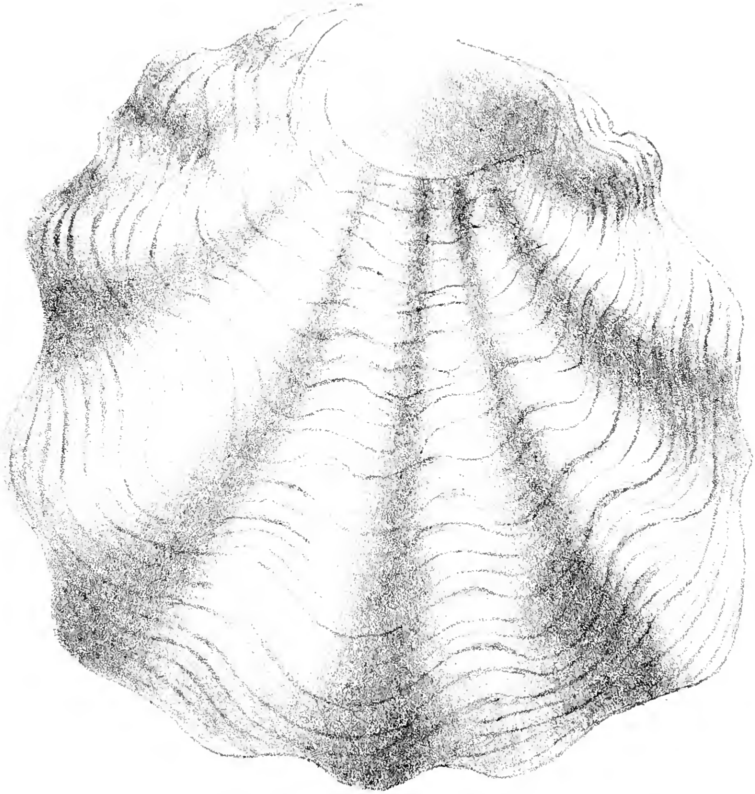
T. Sinclair & Son lith Phila

1. N. subcircula *M.*
2-3. Sten. hasta, *Pfr.*
4. Helix vortex, *Pfr.*
5. H. septemvolva, *S.*
6. C. elegans, *Pfr.*
7. S. Stretchiana, *Bl.*
8. H. pyrozona, *Pl.*
9. Macr. turricula *Pfr.*
10. H. Goldfussi *Mke.*
11 12. H. astur, *Sb.*



W. G. B. del. T. Sinclair & Son lith Phila

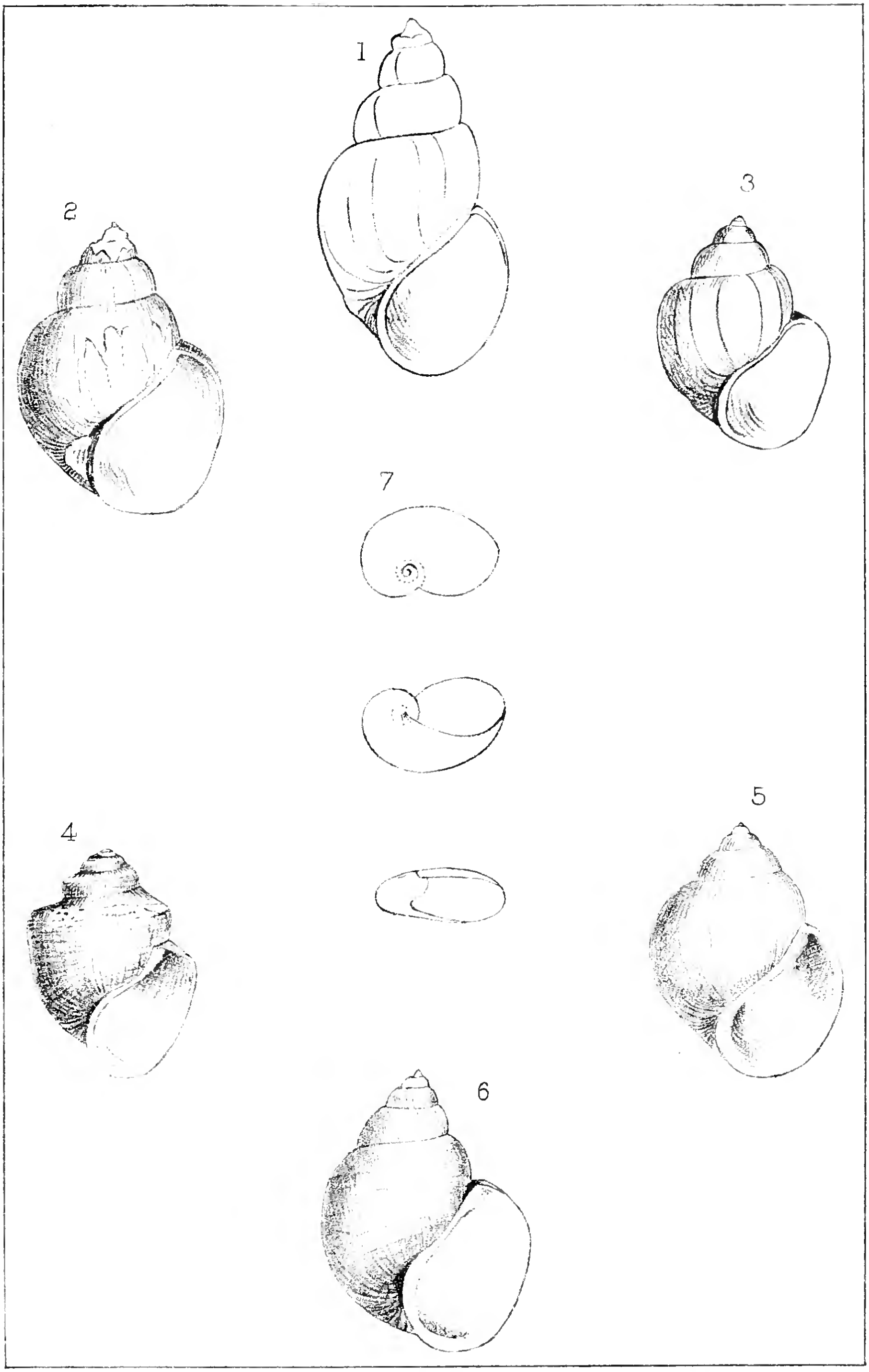
1-2. H. Arangiana, *Py.* 5. H. auricoma, *Fer.* 8. H Sieboldtiana *Pfr.*
3. Macroc euspira, *Pfr.* 6. End. tumuloides, *Garr.* 9. Z. minusculus, *Binn.*
4. H. sagemon, *Bk.* 7. H. convicta, *Cox.*



1

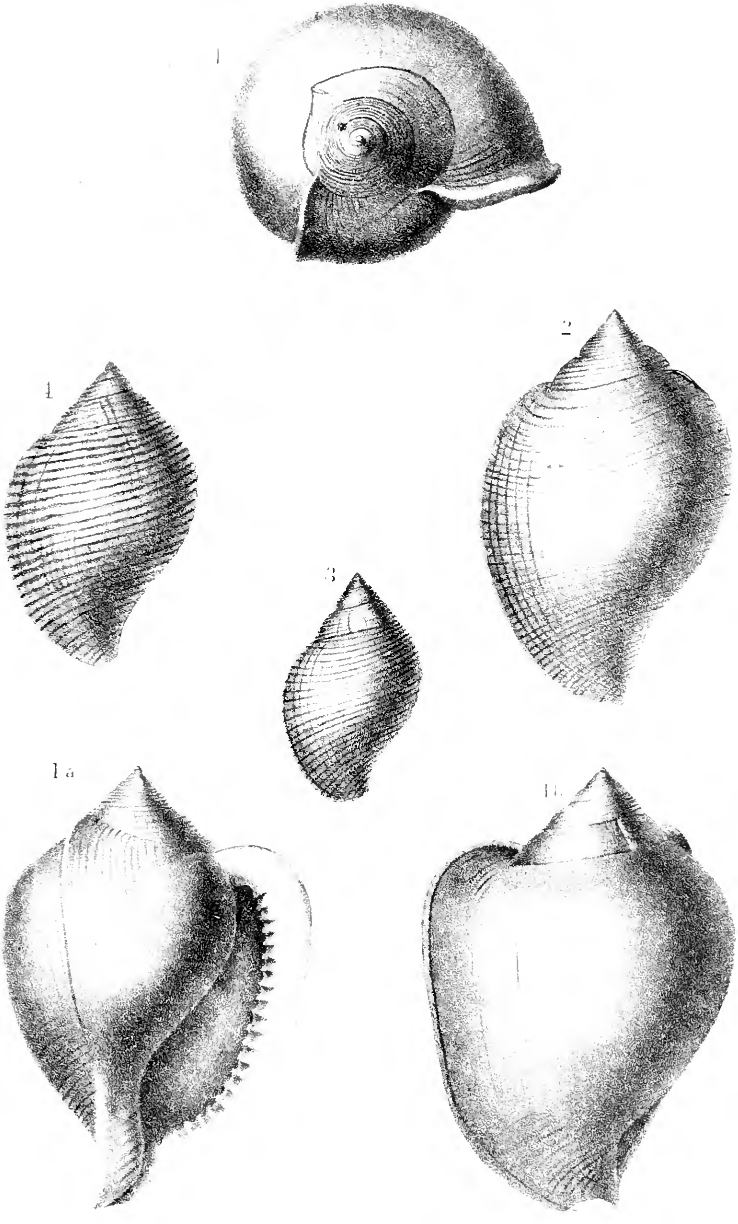
2

Ostrea callacta Conr.



T. Sinclair & Son lith Phila

Lewis on New Land and Fresh Water Shells.


1
1
2
3
1 a
1b

There is no indication of the transverse fissures seen in *Sphenodon* and many *Lacertilia*, nor are there any diapophyses on the caudal vertebræ preserved.

Two vertebræ accompanying the above are similar in general characters, and appear to belong to the sacrum. If truly such, they indicate a structure different from that seen in *Lacertilia* and *Crocodilia*, and present some resemblance, perhaps only superficial, to the Dinosauria. The centrum is much compressed, and the articular extremities present a wide plane border below the notochordal perforation. The corresponding part of the centrum presents no indication of diapophyses. Neural arch lost.

Some heads of ribs of appropriate size are compressed, and exhibit a small tuberosity which is perhaps a rudimental capitulum. They are much more lizard-like than those of *Cricotus*.

The phalanges are of more slender form than those of *Cricotus* and more like those of lizards, although less slender than usual among that order. The shafts are sometimes little, sometimes much depressed. The distal condyle of one of the latter is not emarginate. An ungual phalange is subconic, flat below, and with a shallow groove above one of its lateral borders.

A coracoid bone supports the greater part of the glenoid facet, and exhibits also a facet for the scapula. These are flat, and not excavated. Its form is that of an irregular right-angled triangle, the base anterior and the outer angle truncated by the glenoid facets. Its inner margin is thickened and truncated as though it had been articulated with a mesosternal or opposite coracoid bone. This may not be a correct interpretation of its appearance, for if so, the arrangement would differ equally from that of Sphenodon, Lacertilia, and Salamanders, and resemble that of the *Sauropterygia*. And it is not to be denied that there are other points of resemblance to the coracoid of that order. There is an anterior marginal facet as though for a clavicle, and a short, oblique, posterio-internal one, as though adapted for a small sternum. There is a shallow notch on the inner border anteriorly, corresponding to one of those of the *Lacertilia*.

This genus is more typically Rhynchocephalian than *Cricotus*.

Specific characters.—There is a shallow fossa in the entering angle between the superior and inferior articular facets of the front of the axis, and the centrum of the same is obtusely keeled below. The border of the anterior articular face of the dorsal vertebra with keeled centrum is undulate. The obtuse inferior face of another dorsal is rugulose, and the edge of the articular face is not undulate. The inferior faces of two caudals are marked with two fine parallel grooves, while in another caudal and the ?sacrals the same is smooth. There are some longitudinal ridges on the upper side of the larger caudal. The coracoid is concave on its inferior side, convex on its superior; the inner and anterior borders are thickened by flaring of the edges. Surface smooth. The posterior edge is thin, and is notched just behind the glenoid facet. The proximal facets of the phalanges are shallow, simple, and more or less transverse.

	M.
Length centrum of axis	.006
Width do. at middle behind	.008
Depth do. (oblique)	.010
Length centrum of sharp-keeled dorsal	.014
Depth do. behind	.012
Width do. behind	.012
Length centrum of rounded dorsal	.012
Depth do. behind	.011
Width do. behind	.0105
Width neural canal of do.	.004
Length centrum of larger caudal	.014
Width of do.	.0085
Depth of do.	.008
Length of base of neural arch of do.	.008
Length of smaller caudal	.0105
Depth centrum of do.	.007
Width " "	.007
Width of rib-head	.010
Length of coracoid	.024
Width of "	.019
Diameter of glenoid facet (transverse)	.009
Diameter of inner border (vertical)	.006
Length of a phalange	.010
Depth proximally	.004
Width "	.007

This species was of smaller size than the *Cricotus heteroclitus*. It is dedicated to John Collett, of Newport, Indiana, of the State Geological Survey.

Ceratodus vinslovii, Cope.

Represented by a tooth in good preservation, lacking only a fragment of one end, and a portion of the inner margin of the base.

The crown of the tooth is in general outline an oval, wider at one end than the other, the inner border gently convex and entire. The outer border is marked by six shallow notches which are separated by as many sharp, compressed projections. The emarginations and denticles are the termini of corresponding grooves and ridges, which radiate from a smooth space along the inner margin of the crown. From this plane the grooves gradually deepen to the margin; the separating ridges are acute, and without irregularity or serration. The base or root of the tooth is quite wide. Externally it extends beyond the border of the crown at the notches, and has projections corresponding to the denticles, from which it is separated by a horizontal notch. On the inner side the base extends like a shelf beyond the posterior half of the crown, and is produced backwards beyond its posterior border. The inferior plane is concave in transverse section; the crown is plane in all directions.

	M.
Length of crown preserved	.021
Width of crown	.013
Length of root preserved	.022
Depth of tooth internally	.005
Depth of tooth externally	.003

This *Ceratodus* resembles the species described by Agassiz under the names of *C. parvus* and *C. serratus* from the English Trias, but differs from them in the shortness of the tooth-like processes. In none of the described species do I find such a development of the basis on the inner side.

This species is of interest as introducing the genus to North America. It is dedicated to Dr. Winslow, to whom we are indebted for its discovery.

October 5.

Dr. LeConte, Vice-President, in the chair.

Twenty-five members present.

The following papers were presented for publication:—

"On North American Noctuae." By Aug. R. Grote.

"Notes on the Noctuidæ, with descriptions of certain new species, No. II." By H. K. Morrison.

"Description of a new species of Bird of Paradise of the genus Ptiloris, in the collection of the Academy." By James A. Ogden, M.D.

Observations on Lilies.—Mr. Thomas Meehan remarked that some bulbs of Lilium pardalinum, received last spring from Dr. W. P. Gibbons, had the scales articulated in the middle. The upper portion of the jointed scale fell off easily at the slightest touch, giving the blunt ends of the remaining portion the appearance of grains of Indian corn as they were arranged along the rhizome. Dr. H. N. Bolander has since informed him that it was a common characteristic of this species. It does not, however, appear to have been noticed by monographers of this genus. He had since found that the eastern Lilium superbum had the same character. It was, however, by no means regular. Some bulbs would have a large number of articulated scales, while others had but a few here and there; and they were as likely to be found among the inner as the outer scales. The scales of Lily bulbs were but the dilated and thickened bases of ordinary leaves. There were no articulations in the normal leaves, and it was difficult to trace any morphological relationship in these scale joints.

Another observation he had made on the failure of some bulbs of Lilium canadense to produce seed. He had received a few years ago some bulbs of this species from Mississippi. The flowers proved so remarkably large and beautiful, much superior to those of the northern plant, that he was in hopes to increase it by seeds, but not one seed-vessel formed—though a quantity of L. superbum growing near them set every flower. Supposing that this might be a case where fertilization from other flowers might be a benefit, pollen was applied from others of the species but all of the same Mississippi plants, with no better results. He wished to call particular attention to this little fact, because he believed that physiological agencies in fertilization and reproduction were often lost sight of in the discussions relating to the connection of flowers with insects in this matter. Some remarkable physiological facts had recently been brought to light by Mr. Francis Parkman, of Cambridge, Mass., the eminent historian and good botanist. He had endeavored to hybridize a number of species of Lily with the Japan L. auratum. To guard against the chance of fertilization by their own pollen, the anthers were cut from the flowers before they had perfected, and other precautions taken. There seemed to be no chance of any result but to produce hybrids, or not to seed at all, according to all that has been heretofore known of such subjects. But in every case but one of those which have so far blossomed, the seedlings are like the female parents. There was one remarkable hybrid, and one only. That the male parent should be potential for reproduction, and yet powerless to transmit the slightest trace of its own characteristics, he thought among the most wonderful of the recently discovered facts in vegetable physiology, and would render the Lily family an object of renewed interest.

As remarked before, some Lilium superbum growing near the others bore seeds freely, every flower perfectly, and, so far as he could see, without any special aid from insect agency. He had been interested in noting the remarkable manner in which the seed-vessels varied. He exhibited a number of capsules, selected from twenty-five plants, each plant bearing all its seed-vessels exactly after the pattern of each one exhibited. Some were about two inches long and linear, with rounded ends; others of the same character but with the end promorse, and giving a triquetrous character to the apex. Another had the carpellary edges perfectly smooth, another, perhaps, like it, with tumid raised edges. Then there were lanceolate, oblong, clavate, pyriform, and almost globose forms. In old times many of these characters would have been deemed of sufficient importance to found new species on; in times past, and in our own times under some prevailing theories, the variations would be looked for under some law of external influences modifying form. Without offering any opinion on these points, he would simply observe that all these plants were taken from one small spot at Berlin, New Jersey, and had all been growing in his garden under exactly the same circumstances together.

Remarks on Rhizopods.—Prof. Leidy made the following remarks relating to previous communications on Rhizopods: On my return, after an absence from home since last April, my attention has been called to a critical notice by Dr. G. C. Wallich, in the Annals and Magazine of Natural History for May, 1875, page 370, on my communications to the Academy on our fresh-water rhizopods. Dr. Wallich complains of my apparent inattention to his own researches on the same subjects, published in the Annals for 1863 and 1864. From the character of Dr. Wallich's remarks, I suspect that he has not examined my communications as pub lished in the Proceedings of this Academy. Thus he commences by saying that it had been brought to his notice that Prof. Leidy had published "in some of the American scientific journals an account of researches," and at the end of the article he expresses regret that I should have failed to make any reference whatever to his papers. Aside from the circumstance that my communications to the Academy were only brief verbal notices and not elaborate articles, I nevertheless think I have done no injustice to others in not referring to the literature on the subject, as I have laid claim to but little as new. In my first communication (Proc. Acad. Nat. Sci. 1874, p. 13), I state in general terms that I had recognized a large number of fresh-water protozoa as the same as those described by European authors, and likewise remark that among our fresh-water rhizopods I had observed most of the genera and species as indicated by European naturalists. Of the few names of the latter I have mentioned, that of Dr. Wallich is one, and this I could not have done had I not been familiar with his publications.

Dr. Wallich intimates that even my supposed discovery of the remarkable form for which I have suggested the name of *Ouramœba* has been included in his own published papers. From another notice by the same author, in the May number of the Monthly Microscopical Journal for 1875, page 210, it appears that *Amœba villosa* is the species which Dr. Wallich supposes I have redescribed under the name of *Ouramœba*. Although Mr. Archer, of Dublin, another able investigator of the rhizopods, regards *Ouramœba* as only another condition of *Amœba villosa* from that ordinarily observed, I am not prepared to accept this opinion, for reasons given in a communication to the Academy, and published in the Proceedings of April 20th, 1875, page 126.

In the latter notice of Dr. Wallich, while the author expresses the conviction that I published my papers in ignorance of his having handled the same subjects long before me, he also regrets that I do not entertain the same opinion that he did in regard to the interpretation of characters said to involve generic and specific distinctions.

While extended researches have led me to incline more and more to the views expressed by Dr. Wallich in his exhaustive papers, my published remarks sufficiently indicate that I had not neglected these; for in the particular ones to which he refers, I have either mentioned his name or those of species which he has described.

In conclusion, while regretting that Dr. Wallich or any one else should have occasion to reproach me with neglect of the labors of others, I take the opportunity of stating that my communications to the Academy on the rhizopods have been brief verbal remarks, introductory to the publication of a monograph on the fresh-water forms, in which I shall endeavor to do justice to all who have preceded me in the same field.

While speaking of rhizopods, I may mention that there are two articles on the subject in the last two numbers of the Archiv f. Mikroskopische Anatomie, by F. E. Schulze, entitled Rhizopodenstudien. In these papers several forms are described, which have also come under my observation.

The difflugian described by Schulze as *Quadrula symmetrica*, and first noticed by Dr. Wallich as *Difflugia symmetrica*, with a test composed of quadrate plates, I have also found in several localities in New Jersey.

A difflugian, with a structureless test, referred by Schulze to the genus *Hyalosphenia* of Stein, and described by him with the name of *H. lata*, is the same as the *Difflugia ligata* of Tatem, which I had referred with several other species to a genus under the name of *Catharia*. I had not had access to the work in which *Hyalosphenia* was characterized, and which has priority to *Catharia*. The difflugians referable to it are as follows:—

1. **Hyalosphenia ligata**: Syn. *Difflugia ligata*, Tatem; *Catharia ligata*, Leidy; *Hyalosphenia lata*, Schulze.
2. **Hyalosphenia papilio**: Syn. *Catharia papilio*, Leidy.
3. **Hyalosphenia elegans**: Syn. *Catharia elegans*, Leidy.

The amœban which I have described under the name of *Dinamœba* is almost identical with that described by Schulze with the name of *Mastigamœba* (fig. 1, Taf. xxxv.), and which is probably the same as the *Amœba monociliata* of Carter. *Dinamœba* is, however, devoid of the characteristic flagellum ascribed to the forms of Schulze and Carter. It may, perhaps, prove to be the same as *Dactylosphærium* of Hertwig and Lesser, the description of which appeared in the Archiv nearly at the same time as that of *Dinamœba* appeared in the published Proceedings of the Academy. The former is described as being invested with minute villous appendages of protoplasm, but the latter is covered with minute bacterium-like spicules, such as are represented to exist in *Mastigamœba*.

October 12.

The President, Dr. Ruschenberger, in the chair.

Thirty-five members present.

Quercus heterophylla.—Prof. Leidy exhibited a branch of *Quercus heterophylla* which he had obtained from a large tree, growing on the farm of Mr. J. I. Bishop, in Burlington County, New Jersey. The foliage, he thought, indicated a hybrid between Q. phellos and Q. palustris. He recommended the introduction of this rare hybrid oak into our city park.

On the Notation of the Ribs.—Dr. Allen presented the following argument:—

The rib is a member of a system of arches which are arranged bilaterally, each vertebra having a single pair.

The vertebral end of each dorsal rib bears a facet articulating with its own vertebra. When the end bears two facets the lower one articulates with its own vertebra, while the upper articulates with the vertebra above it. The latter facet may be termed a secondary one, and has no homological value.

Now this method of arrangement of the facets must be true when applied to the sternal end of the rib through its produced chondral segment, the costal cartilage, so that the segment of the sternum bears a strict relation of sequence to the dorsal vertebræ; each segment corresponding to a right and left rib. Thus the first rib belongs to the manubrium, and may be called the manubrial rib. The second, although placed apparently between the manubrium and gladiolus, is named by the position of its lower attachment a gladiolar rib. In the young, the succeeding segments of the gladiolus can be named in the same order as far as the fourth. Beyond this the remaining ribs are so crowded that analysis of them is impossible. It can be seen, however, by studying the arrangement in quadrupeds, that the rule holds good, each rib owning, in a homological sense, its own sternal segment. For the present purpose all that remains of importance is to accept as a leading thought, that when a rib is seen joining any two segments of the sternum—to refer it to the lower of the two. Thus, when the seventh rib is seen joining the sternum at the xipho-gladiolar junction, it is correct to assign the rib not to the gladiolus but to the xyphoid cartilage, and, placing it there, we remove it from the series of the gladiolar ribs.

Now the manubrial and the gladiolar ribs are the true ribs—and these, with the removal of the seventh, are but *six* in number. It will also be seen that were all the false ribs produced they would be xyphoidal ribs.

It is commonly the case that where a rule of notation is established it will be found to be correlative with details both of structure and of function. This is the case in the example above cited. The ribs (first 6) which present concave upper borders, and have a vertical surface at the pulmonary groove, are the true or manubrio-gladiolar ribs, and are those which *ascend* in inspiration.

The ribs (last 6) which present convex upper borders, and yield in the pulmonary groove a surface inclined downward and forward, are the xyphoidal ribs (or which if produced would be xyphoidal) and are those which *descend* in inspiration.

It will be seen that both sets present borders concave to the line of traction of the muscles acting upon them.

OCTOBER 19.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-six members present.

A paper entitled "Observations on the structure of the Manatee," by Henry C. Chapman, M.D., was presented for publication.

OCTOBER 26.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-one members present.

Wm. M. Davis, Jr., and Dr. B. F. Stephenson, U. S. N., were elected members.

Prof. Karl A. Zittel, of Munich, and Prof. Wilh. C. H. Peters, of Berlin, were elected correspondents.

The committee to which they had been referred, recommended the following papers to be published :—

ON NORTH AMERICAN NOCTUÆ.

BY AUG. R. GROTE.

Apatela Harveyana, n. s.

♀. Allied to *hasta* and *Radcliffei;* a little larger and differing by the increased size of the stigmata, which are not joined by a dash, as they are in *hasta.* Fore wings pale bluish-gray. Basal black dash arrested at the inner component line of the widely geminate transverse anterior line. Orbicular large, irregularly ovate, differing in shape from the same spot in allied species. Reniform very large, luniform. T. p. line shaped as in *hasta.* The two dashes on terminal space, one above internal angle, the other opposite the disk, are linear and fine. Secondaries fuscous, beneath paler with discal lunule and dentate median line.

Expanse 42 mm. Sharon Springs, N. Y., O. Meske, July 23, named for Dr. Leon F. Harvey, of Buffalo.

Apatela (Eulonche) **lanceolaria,** n. s.

♂. A species allied to *oblinita,* but differing by the yet narrower, lanceolate, pointed primaries. Color like *oblinita,* a little more bluish-gray, the fore wings covered with white scales over a blackish ground. All the markings confused, the t. p. line alone to be distinguished, not fragmentary and sinuate as in *oblinita,* but continuous, angulate on median nervules, and very near external margin; it is crossed by two black dashes opposite the cell; a longer one before internal angle. Hind wings pure white. Beneath white; *no discal marks.*

Expanse 42 mm. Newtonville, Mass., Mr. Roland Thaxter, June 6, No. 36.

Mamestra vindemialis, n. s.

♀. A species of large size with hairy eyes and habitus of *Hadena sputatrix.* Fore wings entirely deep purple or vinous red; veins shaded with blackish. Ornamentation obsolete. Reniform narrow, indicated by powdery scales. The four ante-apical pale dots distinct. Thorax and head like fore wings; beneath, the body is tinted with vinous. Hind wings yellowish-fuscous, tinted with vinous on the dusky borders. Beneath, without discal marks, shaded with vinous and with a faint median shade line.

Expanse 40 mm. Newtonville, Mass., Mr. Roland Thaxter, June 24.

Heliophila lapidaria, n. s.

♂. ♀. A species allied to *phragmitidicola* and *adjuta*, with immaculate white secondaries in both sexes. The fore wings resemble *pallens* and *adjuta*, but are less yellowish; they are terminally interspaceally darker shaded, the veins whitish. The shade under the median vein is not black, nor darker than the terminal shades. There is a black cellular dot, and the t. p. line is indicated by two disconnected dots as in *pallens*, *adjuta*, not by a series of points as in *phargmitidicola*, and *adonea*. A terminal series of points on the white hind wings above, noticeable on both wings beneath. Collar with three lead-colored lines. The species is a little slenderer than *phragmitidicola*, and wants the terminal shading to the hind wings.

Expanse 34 to 36 mm. Buffalo, N. Y.

I have discovered in examining a collection of Canadian Noctuidæ named by the late Mr. Francis Walker, that *multilinea*, Walk., is the same species as *commoides*, Guen.

Helotropha atra, Grote, Proc. Acad. N. S. Phila. 1874, 200.

♂. ♀. Both sexes of this form have been taken by Mr. Wm. Saunders, London, Canada; it has also occurred to Mr. Lintner, near Albany, N. Y. It differs from *reniformis*, by the smaller, compact, whitish reniform, this, with the concolorous brownish-black fore wings, gives the moth a resemblance to *Hadena sputatrix*, Grote. The faintly expressed ornamentation resembles that of *Helotropha reniformis*, Grote. I believe it to be a distinct species.

Hadena diversicolor.

Demas diversicolor, Morr. Proc. Bost. S. N. H., 132, 1874.

I have examined the ♀ type of this species belonging to Mr. Thaxter. The position of the accessory cell is not as in Demas (Lederer's Taf. 1, fig. 3). The palpi are not "short and hanging," nor is the head "drawn in" any more than in *Hadena finitima*, for example. It may seem "a wide leap," but the species is a *Hadena* and not a *Demas*, and this latter genus is not as yet shown to occur in North America. The ornamentation strongly resembles that of *Hadena modica*, and the structure and the characteristic ringlets beneath on the disk, replacing the usual form of the discal mark, show the moth to be naturally grouped with our species which Mr. Guenée calls "*Apamea*," but which I have referred to *Hadena*.

Hadena vultuosa, n. s.

♂. ♀. Belongs to the section *Xylophasia*, and is very closely allied to *H. lignicolor*. It is a little smaller than this species. The red color is wanting. The tegulæ are blackish-brown; disk ferruginous. The ground color of the wings is a pale obscure ochreous. The costa is shaded with dark-brown, and this shade obtains on terminal space and runs inwardly in two places, at internal margin and opposite the cell, as in *lignicolor*. The ground color of the wing is free from dashes of darker shade over the median and subterminal spaces. There is a brown shade on the internal margin at base. The transverse lines are indicated by costal streaks. The stigmata are much as in *lignicolor*, but narrower. The t. p. line is usually seen as a single faint line, scalloped and succeeded by a double series of dots on the points, the inner series black and evident. Beneath there is an indistinct common shade line. Specimens from Canada (Mr. Saunders) and New York (Mr. Robinson) seem larger than the figures of the European *rurea* which I have seen, and differ by the absence of any whitish shade on internal margin, and by the discal dots beneath being solid. I have catalogued this species as *rurea*, from a determination received from the late Mr. Walker. But there is sufficient evidence now that the European species is different, while a nearer comparison must be postponed until European material can be obtained.

Mamestra Dimmocki, n. s.

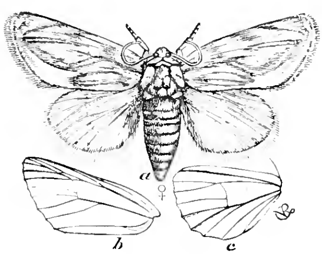
♀. Allied to *subjuncta*, G. and R.; of the same blackish-brown color, differing by being darker and more reddish, by the absence of the median dash and the want of the prominent W-mark to the subterminal line. Collar with a black line. Fore wings with a short distinct black basal dash. Median lines blackish, indistinct, lunulate, approximate Orbicular large, luniform, excavate on the inner side; reniform large, medially constricted, shaded with blackish over median nervules; claviform merely outlined. Median shade line ferruginous below the reniform. Subterminal line nearly straight, a series of interspaceal cuneiform ferruginous spots surmounted by pale atoms. Hind wings dark fuscous, with pale fringes. Beneath thickly powdered with blackish, with a slight ruddy stain; hind wings with dot and line.

Expanse 40 mm.

From the White Mountains, New Hampshire, collected by Mr. Geo. Dimmock, for whom I name the species.

Cirrhophanus triangulifer, Grote, Can. Ent. 4, 187.

♂. Antennæ with thickened scape, simple, scaled above, ciliate beneath. Eyes naked. Thorax tufted; wings rounded. Front roughened, tuberculate; palpi slender, short. Legs unarmed. Rich, rather pale, silky yellow, with deep yellow linear shadings. Fore wings with the usual markings wanting. All the markings deep ochre-yellow, consisting of curved or straight shadings on the veins and interspaces. The t. p. line seems near the margin, geminate, shaded, even, forming a rounded sweep from opposite the cell to below vein 2, where it is indented; it here appears to be disconnected, running back on the vein; below this two curved ochre lines on each side of vein 1 seem to meet on the t. p. line. Thus two triangulate spaces are formed on the primary. Subterminal and terminal lines indicated. Fringes and hind wings shiny yellow. Beneath yellow without markings.



Expanse 40 mm. Kansas, Prof. Snow.

By the kindness of Professor C. V. Riley I am enabled to present the annexed beautiful wood-cut, illustrating the female type of this species and showing the neuration. The student is referred to the original paper for my remarks on the structural affinities of the moth, which seem to me to lie with *Gortyna*.

Lygranthoecia limbalis, n. s.

♀. Allied to *arcifera*. Fore wings deep shining blackish-brown; thorax more reddish. All the lines obliterate; the annulets of the reniform can be made out. On the middle of the wing there is a whitish patch on internal margin, and one above it, smaller, on costa. Hind wings black, immaculate, with pale fringes. Beneath black, with the terminal spaces reddish. Abdomen black, with the terminal segment yellowish.

Expanse 20 mm. Habitat, Kansas, Prof. Snow.

Aedophron Snowi, n. s.

♀. Eyes naked; tongue stout; fore tibiæ short, with terminal and lateral claws; hind and middle tibiæ spinose. Wings shaped as in A. rhodites from Europe, and colors the same. The American species is larger and stouter, and has less rose-color on fore wings. Thorax and fore wings pale lemon-yellow, color of *Heliothis citrinellus*, G. and R. Fore wings with a light roseate shading beyond the cell, and with the sinuate t. p. line faintly indicated in rose-color. Some roseate basal shades and at the place of the t. a. line. Hind wings pale fuscous, with a rosy terminal stain; fringes pale. Beneath primaries fuscous, with rosy apices; hind wings yellow, with rosy tint near anal angle. Body stout.

Expanse 32 mm. Hab. Lawrence, Kansas. Prof. F. H. Snow, for whom I name the beautiful species.

Agrotis Hübner.

Both of the first two of the following forms were communicated by me to Mr. Morrison of Cambridge, in response to his request to send him new species for his intended paper on the genus. Both were returned by him as varieties of A. auxiliaris, *Grote*. It is possible that this view will be found correct; still it will be proper to give the forms different designations. I have A. auxiliaris from Texas and Colorado.

Of the first form I have two female specimens before me, collected with a number of other specimens by Mr. Jas. Ridings in Colorado; I have also donated one to Mr. Morrison. The color is much paler than *auxiliaris*, and there is a resemblance in this form to *messoria*, from which it differs by the more dentate transverse anterior and distincter terminal line, as well as by the darker secondaries and larger size. There is a faint ochrey shading, more visible in the median space. The reniform is smaller, a little blackish stained at base, the claviform shorter and narrower and only visible at apex, compared with *auxiliaris*. There is no blackish basal dash nor whitening of the vein above it; and no indication of the submedian stripe. Else the markings are much like *auxiliaris*, while the primaries are more uniform in their neutral tint. The smoky secondaries with white interlined fringes are much as in *auxiliaris;* beneath the discal mark is more prominent.

Expanse 42 mm.

Agrotis introferens, n. s.

I have a fine male specimen sent me by Mr. E. L. Graef, from Texas. It resembles *perexcellens* from California in coloration, but is narrower winged and has the habitus of *auxiliaris*. It differs by the collar at base being ochreous, divided by the central black line from the superior dark brownish portion. The costa is broadly striped with ochreous to the reniform. The stigmata are distinctly inter-annulate with white, and the median vein is white lined. The subterminal space is shaded with ochreous or pale leather-brown, and the internal margin also shaded with the same color, recalling *fennica*. The orbicular is more irregular and angulate in shape, and larger. The claviform is less prominent, and there is the same ochrey submedian stripe as in *auxiliaris*. Hind wings and under surface much like the other forms.

Expanse 42 mm.

Agrotis campestris, n. s.

Allied to *tessellata*. It differs by its larger size, the even dark purple-brown of the primaries and thorax; the latter and the fringes being in one specimen shaded with ferruginous. The black shading on the cell is more obvious, and the transverse lines distinctly marked in black. Hind wings usually darker than in *tessellata*, with fringes almost entirely fuscous. Under side like *tessellata*, of which this may be a modification, but, if so, its distribution is singular.

Expanse 35 to 37 mm. Vancouver Island, Mr. Henry Edwards, No. 5644; Canada, Mr. Geo. Norman; N. Y. Mr. Theo. L. Mead, No. 131.

Agrotis cinereomacula, Morr.

♀. A species allied to *perexcellens* in colors and ornamentation. Fore wings either entirely ochrey or pale leather-brown or with the median space and middle of the wing from t. p. line to base shaded with red-brown. The variation consists in the amount of red-brown shading to the wing; in either case the subterminal space costa and internal margin are ochreous. Stigmata rather large, ashen, of the usual shape, with black annuli; cell shaded with blackish-brown. Subterminal line preceded on costa by a brown shade, leaving the ochreous tint of the s. t. space to spread over apices. Terminal space narrow, irregular, filled with blackish below vein 7. Median vein narrowly white-lined; a black dash between basal and t. a. line below the vein. Thorax red-brown; collar at base ochreous. Transverse median lines on fore wing sub-obsolete. This species is broader winged than *introferens*, and very like *perexcellens*, Grote, from the Pacific coast, differing by the shorter claviform, the more ochrey hue, and apparently by the less prominent lunulations of the t. p. line.

Expanse 38 to 40 mm. Canada, Mr. Geo. Norman.

Mr. Morrison has sent me a specimen under this name that I refer to this species. His brief description cannot possibly be used to identify the species. Compare Bost. Proc. 1874, p. 164.

Agrotis gularis, n. s.

♂. Possibly a form of *cinereomacula*. Antennæ feebly brush-like. Seems to be a shorter winged and stouter species. Anterior wings and thorax entirely unicolorous shining purplish red-brown. Stigmata interlined with pale powdery scales, defined by black annuli, concolorous, of the usual shape. A black dash below median vein, which extends from base to t. a. line, the latter fragmentary. Cell shaded with blackish. Claviform black outlined, short, and sharp. T. p. line obsolete. Terminal space blackish stained, and there is a preapical deeper costal shade before the inception of the s. t. line. Hind wings smoky fuscous; fringes dark. Beneath with lunule, subirrorate, and darker than in the preceding species.

Expanse 35 mm. Canada, Mr. Geo. Norman, No. 381.

Agrotis haruspica, Grote.

Mr. Morrison (Proc. Acad. Nat. Sci. Phila. 1875, 59) says that I am in "error" with regard to the name *unimacula*, proposed for this species by himself, that it is not preoccupied in the genus, "the name is used by Dr. Staudinger for a simple variety of the common *A. plecta*, Linn." Mr. Morrison seems to be unacquainted with the discussion carried on in the Wiener Ent. Monatschrift by Lederer with respect to the Andalusian *A. unimacula*, Staud. Lederer regarded the Spanish species as a form of *leucogaster*. not *plecta*: on the other hand, Staudinger cites it with doubt in his last Catalogue as a variety of *plecta*, considering it still to have claims to rank as a species, as which he at first described it. In no event, whether for a species or a variety, could the same name be used twice in the same genus. In a difficult matter, like that of *unimacula*, Staud., a statement from Mr. Morrison, without even specimens before him, can hardly as yet correct European lepidopterists, or affect the operation of a rule in zoological nomenclature.

Mamestra lubens, Grote.

Mamestra rufula, ‖ Morr. Proc. Acad. N. Sci. Phila. 1874, 62.

The name here retained I have proposed in the Trans. Ent. Soc. Phila., in a paper issued prior to my receipt of Mr. Morrison's pamphlet. I have not, at this writing, the complete data before me, though, I believe, I have priority; the question is not material, for I have employed the name previously for a Californian species, *Dianthœcia rufula;* and the validity of Boisduval's genus is disputable since the discovery of American forms. The absence of the tibial spinule is omitted in Mr. Morrison's comparison with the European *brassicæ.*

Parastichtis minuscula (Morr.).

♀. A small species with the genital process extended. This is, though not prominently visible, the remarkable character in this genus with naked, lashless eyes, and unarmed tibiæ. The present species has apparently no tufts on thorax, and none on abdomen; neither of my two specimens are, however, perfectly fresh. The colors are somewhat like *meditata.* Dark lilac gray; terminal space contrastingly paler. A faint reddish tinge about median space. The claviform is indicated by a black dash, which extends across the median space. The lines are faint; t. p. line very sinuous, narrowing the median space. Reniform upright, narrow, concolorous; orbicular ovate, oblique. Hind wings blackish-fuscous, with paler fringes. Beneath dark, subirrorate; hind wings paler at base; a reduced discal dot and very obscure double common lines. Thorax like fore wings.

Expanse 23 mm. Orillia, Mr. Geo. Norman, Nos. 399, 401, Sept. 9.

There is a faint resemblance to *finitima* in this much smaller species.

Fala, n. g.

A form allied by the conformation of the clypeus to *Stibadium* and *Plagiomimicus.* The front is entirely cup-shaped, excavate, raised rim-like around the edges; from the centre a broad wedge-shaped horn or prominence arises. Tibiæ unarmed; fore tibiæ with a terminal claw. Eyes naked, unlashed. Thorax untufted;

abdomen short, untufted. Primaries widening outwardly, with depressed costal margin. Antennæ of the male simple, ciliate.

Fala ptycophora, n. s.

♂. Fore wings gray, shaded with ochreous, especially in two stripes from the base outwardly across the disk, and downwardly below median vein to internal angle. T. a. line geminate, deeply and widely dentate. Orbicular shaded with white, rounded, annulate with blackish-brown. Reniform narrow, elongate, scroll-shaped, white with brown annulus. Median space very wide, the t. p. line very near the subterminal, geminate, regularly lunate, not very distinct. Subterminal line shaded with blackish, and preceded by some very prominent white-filled dentations inferiorly. Fringes dark, interrupted narrowly with pale opposite the extremity of the veins. Hind wings fuscous, beneath with prolonged lunule and faint median line. Thorax and head mixed gray and blackish; tegulæ rather prominent, recalling allied genera.

Expanse 32 mm.

Hab. California.

Heliothis luteitinctus, n. s.

Allied to *phlogophagus*, from which it differs by the light yellow hind wings, with a broad black lunule and black hind margin interrupted in the usual place with yellow. Beneath both wings clear yellow, on the hind wings the discal mark is larger than in its ally, flask-shaped, narrowed superiorly, the terminal black band is reduced to a black submedian patch. In color of primaries and in their indistinct marking this species is very similar to *phlogophagus*: the medium shade is, however, absent.

Expanse 30 mm. Nebraska, Mr. Dodge, No. 51.

Tarache augustipennis, n. s.

With the colors of *biplaga*, this species resembles rather *terminimaculata* in the shape of the wings; the primaries are slightly produced at internal angle, and are unusually narrow; form slenderer than in its ally. Thorax and head blackish; palpi and under surface of body and collar at base whitish. Fore wings blackish, with a white stripe along median vein (and spreading above it nearly to costal edge) to the place of the t. a. line. A white curved fleck on the cell, sometimes connected with the basal dash. A broad pre-apical white costal mark, and a narrower one beyond it surmounting the whitish terminal space, where the whitish color extends backwards on internal margin to the curved t. p. line, which is only visible inferiorly. A black terminal line; other ornamentation indistinct. Fringes long, interlined. Hind wings pale fuscous, with whitish fringes. Beneath testaceous whitish, glistening; primaries shaded medially with fuscous. Abdomen whitish, yellowish at tip.

Expanse 25 mm. Texas, Bosque Co., G. W. Belfrage, No. 493, June 5.

Catocala Alabamæ, n. s.

Allied to *grynea* (=*nuptula*, Walk.), but differing by the paler primaries, which want the ferruginous tone on internal margin, and in certain details of ornamentation. Size a little under *grynea*. Primaries pale, but very slightly glaucous-gray. Lines black, not brown. Transverse anterior distinct and running outwardly obliquely to submedian fold, thence obsolete. Its shape is less rounded than in *grynea*, and it is not so strongly denticulate anteriorly. Reniform vague, without distinct interior annulus, and with a whitish exterior clouding. Transverse posterior line as in *grynea*, but it does not extend so far backwards towards the t. a. line at internal margin. Subterminal space shaded with obscure brownish, inferiorly becoming blackish. Subterminal line whitish, rather distinctly dentate. Terminal lunulated line distinct. Hind wings a little brighter yellow than in *grynea*, with the band less than half the width, very uneven, much constricted anteriorly, running narrowly and unevenly nearly to internal margin. Basal black hairs limited. Terminal band interrupted, allowing of a larger apical yellow mark than in its ally. Beneath without any traces of a basal transverse clouding or band on the fore wings, else with a similarity to *grynea*.

Expanse 42 mm.

Hab. Demopolis, Ala. (A. R. Grote.)

On pages 221–223 of the second volume of the Bulletin of the Buffalo Society of Natural Sciences, I have given the additional species described since the publication of the List of North American Noctuidæ. The number of species was thereby increased to 83. Since that time five additional species have now been published, one of which (*editha*) I have not seen. The five species are C. Nebraskæ, *Dodge*, C. Editha, *Edw.*, C. Belfragiana, *Harvey*, C. Verrilliana, *Grote*, C. Alabamæ, *Grote*.

NOTES ON THE NOCTUIDÆ, WITH DESCRIPTIONS OF CERTAIN NEW SPECIES. NO. II.

BY H. K. MORRISON.

Arsilonche albovenosa, Göze.

Leucania henrici, Grote. Bull. Buff. Soc. Nat. Sci., vol. i. p. 10. Pl. 1, fig. 15, 1873.

Leucania evanidum, Grote, l. c. fig. 16.

Ablepharon henrici, Grote, l. c. p. 112.

Ablepharon evanidum, Grote, l. c. p. 112.

Aberr. *Abl. fumosum*, Morr. l. c. p. 275.

We have sent to Dr. O. Staudinger, the eminent European lepidopterist, specimens of *Ablepharon henrici*, and he has pronounced it identical with *albovenosa;* specimens of the latter received from him a short time ago have been compared with *henrici* and *evanidum*, and confirm his decision; the latter is the form in which the interspaceal lines are almost obliterate, and seems the most common here as well as in Europe; *fumosum*, however, we now believe to be an aberration, in which the entire wings are suffused with smoky black. *Abl. absidum*, Harvey, we do not know, but if a good species, it should be referred to *Arsilonche*. The place of this genus is at the head of the Noctuidæ, near *Acronycta*, not near *Leucania;* this is confirmed by the larvæ, which have been observed in this country, as well as in Europe.

Panthea leucomelana, nov. sp.

Expanse 40 mm. Length of body 14 mm.

Eyes hairy. Head sunken. Thorax untufted, with coarse villosity. Abdomen short and untufted. Tibiæ unarmed. Antennæ of the male testaceous, serrate, with a white tuft at the base. Palpi very short and weak. Anterior wings white, crossed by four black dentate lines; half line present; basal and interior half of the median space white, crossed by the distinct well-defined interior line, the orbicular spot appears as a black dot; exterior half of the median space black, with the exception of a space above and around the small black encircled reniform spot; exterior line strongly dentate, and drawn in beneath the cell; subterminal line very irregular, preceded by a more or less distinct diffuse black shade; black shadings in the terminal space.

Posterior wings whitish, with the veins black, and two diffuse irregular lines, one median the other subterminal.

Beneath whitish, with black discal dots, the wings are crossed by three black diffuse common lines.

Hab. Maine. New Hampshire.

Collection of H. K. Morrison.

This insect is highly interesting, as being the second species discovered of the genus *Panthea*, which until now has had only one representative, the European *P. coenobita.*

The two species have much in common, although there is considerable difference in ornamentation, in the color of the antennæ, and in size.

Agrotis fernaldi, nov. sp.

Expanse 41 mm. Length of body 18 mm.

All the tibiæ spinose. Collar having a black transverse line. Pterygodes gray, edged with brown. Thorax gray. Abdomen yellowish. Anterior wings dark and light gray, shaded in parts with brown, and with all the markings very distinct; a short basal dash, beyond it and at the costa the basal space is shaded with brown; interior line light gray, with a black accompanying line, outwardly oblique from the costa to the subcostal vein, inwardly oblique from the subcostal vein to the submedian vein, and below this vein forming a long projecting tooth; claviform spot outlined in black, ordinary spots large, contrasting, and filled with light gray, the orbicular preceded by a black shade, and the space between it and the reniform black; exterior line even and continued, black, followed by a light gray shade line; subterminal space dark, terminal space light, and contrasting.

Posterior wings grayish-fuscous, culminating in a subterminal dark gray shade, terminal space very light.

Beneath, nearly uniform grayish-fuscous, traces of a median line and discal dots on the posterior wings.

Hab. Orono, Maine. (From Prof. C. H. Fernald.)

I dedicate this superb species to its discoverer, the professor of natural history at the Maine Agricultural College.

Agrotis tristicula, nov. sp.

Expanse 40 mm. Length of body 19 mm.

All the tibiæ spinose. Antennæ in the male serrate. Collar with a heavy, black, transverse line. Head and thorax purely gray. Anterior wings gray, the transverse lines nearly obsolete; a distinct, long, black, basal dash; ordinary spots as well as the costal region slightly lighter than the ground, the former having partially effaced black annuli, the space between them dark; transverse lines, where present, geminate; a series of subterminal cuneiform spots replacing the usual line, a lobate line at the base of the concolorous fringe.

Posterior wings light at the base, darker towards the margin, fringe light. Under surface unmarked.

Hab. Orono, Maine. (Prof. C. H. Fernald.)

Agrotis hortulana, nov. sp.

Expanse 37 mm. Length of body 15 mm.

Eyes naked. Antennæ of the male serrate, with the serrations pubescent. Front and vertex yellow-brown. Collar with a brown central line. Thorax yellowish-gray, with a dorsal divided tuft. Abdomen rounded, untufted, the lateral tufts brownish.

Anterior wings uniform, faded yellow-gray, with the ordinary markings nearly obsolete; veins darker than the ground; traces of the ordinary spots; the subterminal line is faintly seen, preceded by a series of faded cuneiform marks. Posterior wings white. Wings beneath uniform whitish-gray.

Hab. San Francisco, Cal. (Mr. A. Agassiz).

From one specimen in the Museum of Comparative Zoology.

This species seems to be distinct from the numerous Californian species published by Mr. Grote, many of which are unknown to me.

Mamestra quadrannulata, nov. sp.

Expanse 30 mm. Length of body 15 mm.

Eyes hairy. Front, palpi, collar, and prothorax black, shading to gray towards the abdomen. Abdomen gray. Basal and median spaces of the anterior wings crossed by two broad longitudinal yellow-brown bands, one costal, the other extending along the inner margin; these bands inclose a central triangular purple-gray or purple-black space, in the upper part of which the two ordinary spots are seen, very small, of the same size, concolorous, surrounded by incomplete intense white annuli; a long black basal dash reaching to the small black encircled claviform spot; median transverse lines entirely obsolete; subterminal line consisting of a series of white dots, preceded by black cuneiform dashes; a black line checked with white at the base of the black fringe.

Posterior wings gray at the base, with a dark terminal border, fringe white. Anterior wings beneath black; posterior wings white, with a dark costal and terminal border. Abdomen untufted.

Hab. Glencoe, Dodge Co., Nebraska.

From Mr. G. M. Dodge (No. 38).

The form of the basal dash and the very conspicuous ordinary spots will quickly distinguish this species.

Hadena minuscula, Morr.

Proc. Bost. Soc. Nat. Hist., vol. xvii. p. 147 (Orthosia).

This species is allied to the European *Hadena literosa.* The reference to Orthosia was caused by the defective condition of the type.

Metahadena, nov. gen.

♂. Antennæ simple. Eyes naked. Ocelli present. Palpi upright, short, stout, and thickly clothed, the terminal joint small and rounded. Front rounded, a small, white scale tuft at the base of the antennæ. Collar rounded, produced in the middle, forming a slight elevation. Thorax smooth, clothed with mingled scales and hair, no metathoracic tuft. Abdomen untufted. Tibiæ unarmed.

M. atrifasciata (nov. sp.).

Expanse 35 mm. Length of body 14 mm.

Head, thorax, and abdomen black. Anterior wings cinereous, the median space black; half line present: interior line obliquely outwardly curved, bounding the median black space; ordinary spots obsolete; exterior line evenly inwardly curved; traces of the subterminal line, which is preceded before the costa by a black shade; the veinlets in the terminal and subterminal spaces finely marked with black.

Posterior wings pure white at the base, an even very broad black terminal band.

Beneath, the anterior wings are black, the posterior wings have the markings above reproduced, but the terminal band is narrower.

Hab. Orono, Maine. (Prof. C. H. Fernald.)

This beautiful species can easily be distinguished by the vivid contrast of its colors.

Tapinostola variana, nov. sp.

Expanse 27 mm. Length of body 14 mm.

Eyes naked. Legs unarmed. Thorax and abdomen untufted.

Anterior wings having all the nervules white and contrasting, and the spaces between them filled with black, brown, or yellow longitudinal streaks; the median vein is accompanied and set off with black, behind it a distinct yellow streak, and below this a heavy black one; a black line at the base of the concolorous fringe. Posterior wings uniformly gray. Beneath gray.

Hab. Detroit, Mich. (Hubbard).

From specimens in the Museum of Comparative Zoology and collection of H. K. Morrison.

The material is in very poor condition, but we believe the species should be referred to this genus, not hitherto represented in our fauna.

Dyschorista gentilis (Grote).

Tæniosea gentilis, Grote. Bull. Buff. Soc. Nat. Sci., ii. p. 143–144, 1874.

We have received from Dr. Staudinger specimens of the two European species of *Dyschorista*, Led.; we find *D. suspecta* to be very closely allied to our *gentilis*, and, we believe, identical with it, but until more material is received and compared we retain them under separate names. *Tæniosea perbellis*, described by Mr. Grote in the same paper, should also be referred to *Dyschorista*.

Tæniocampa vegeta, nov. sp.

Expanse 38 mm. Length of body 18 mm.

Eyes hairy. Antennæ slightly pectinate, white. Palpi ascending, below brown, above white, the third joint rather long. Thorax and abdomen untufted.

Anterior wings and thorax brown, with dull blackish shades along the veins and costa; ordinary lines darker brown, accompanied by a light shade, the interior line arcuate, the exterior deeply and abruptly drawn in beneath the reniform spot; orbicular spot obsolete, reniform darker than the ground, well sized; two black distinct spots on the subterminal line before the apex, otherwise the line is indistinct; fringe concolorous.

Posterior wings blackish-gray, lighter at the base; fringe white at the anal angle.

Beneath whitish, covered with gray atoms, distinct discal spots, and traces of a subterminal band.

Hab. Dallas, Texas (Boll).

From collection of H. K. Morrison.

We refer this species to this genus for the present, although it offers certain structural differences which, perhaps, will require its separation in the future.

Orthosia immaculata, nov. sp.

Expanse 37 mm. Length of body 17 mm.

Eyes apparently naked, with strong lashes. Antennæ of the male pubescent.

Head and thorax reddish-brown, the latter smooth and without dorsal tufts. Abdomen short and untufted. Tibiæ unarmed.

Anterior wings uniform reddish-brown, having the lines obsolete; the ordinary spots small, black, and obscure; fringe red, preceded by a suffused black terminal band.

Posterior wings brownish-fuscous, the veins red; fringe also red, tipped with white.

Beneath both wings are uniform brownish-fuscous, with the veins and costæ reddish.

Hab. South Nevada (Crotch).

From the Museum of Comparative Zoology.

The head of the single specimen examined is mouldy, but the eyes appear to be naked.

On the Occurrence of Orthosia Lota in America.—Mr. W. V. Andrews, of Brooklyn, has been so kind as to send me from his collection a specimen taken in New Jersey, which possesses the greatest interest, being the only example known at present of the species mentioned by M. Guenée in the following extract:—

"J'ai sous les yeux un dessin représentant une Orthosie américaine qui paraît complètement identique avec notre *Lota ;* mais la chenille, qui est figurée auprès, n'a pas le moindre rapport avec la nôtre. Elle est d'un jaune d'ocre clair, avec deux bandes dorsales rousses, liserées de noir des deux côtés, et deux lignes rousses parallèles au-dessus de la stigmatule. Les trapézoïdaux ne sont pas visibles Si Abbot n'a pas commis l'erreur, la *Lota* américiane est une espèce toute différente, malgré sa ressemblance avec celle d'Europe."

M. Guenée states that Abbot's figure of the American Orthosia seemed entirely identical with the European *Lota;* some allowance should be made, however, for the necessary imperfection of a drawing, which, though giving the general impression of the insect, would be likely to omit the nice shades and markings of so great importance in its correct determination.

In fact the American specimen before me, compared with a large number of the true *lota*, presents many differences, which together with the entire dissimilarity of the larvæ (in case Abbot's observations are verified) seem to require a separate designation. I propose therefore the name *Orthosia americana.*

These are the differences between the perfect insects: in *O. americana* the ground color is suffused with carneous and less purely grayish than in *O. lota;* the transverse lines are less distinct; the orbicular spot is upright and figure of eight shaped, formed of two annuli just touching, not a single very oblique narrow annulus; the reniform spot is wider, larger, and more distinctly quadrangular; the light subterminal line is more evident, distinctly bent below the middle, and having two slight projections corresponding to the usual teeth, and in particular it is preceded by a broad conspicuous red shade, instead of a narrow linear one; and finally on the under surface of the posterior wings the median line is narrow and twice undulate, not broad and nearly curved.

The question cannot be considered as settled until the larva of *O. americana* is discovered and compared with that of *O. lota*, but for the present the presumption is in favor of the distinctness of the species.

Thalpochares carmelita (nov. sp.).

Expanse 15 mm. Length of body 7 mm.

Eyes naked. Ocelli present. Head, thorax, and abdomen slender, white.

Anterior wings white, having a strong tooth at about the middle of the inner margin, as is seen on a much larger scale in *Calype* and some European species of *Lophopteryx:* costal portion of the basal space olivaceous; the wings are crossed by two suffuse broad dull olivaceous bands, the first reaching the inner margin at the tooth, the second or subterminal line crosses the wing at the usual place; it is followed by two black dots, one at the apex, the other at the inner angle; the exterior line is faintly seen between the two bands; reniform spot obsolete; the orbicular present as a black dot. Posterior wings white, with a faint terminal border.

Beneath white; the anterior wings with a broad black costal border; posterior wings with a series of black dots at the base of the fringe.

Hab. Dallas, Texas (Mr. Boll).

From the Museum of Comparative Zoology at Cambridge.

Notwithstanding the peculiar tooth on the margin of this species, it appears to be congeneric with the European *T. paula*, which it resembles in size and markings.

Syneda ingeniculata, nov. sp.

Expanse 38 mm. Length of body 14 mm.

Anterior wings bright gray, covered with numerous darker gray atoms, subterminal space dark; half-line present; interior line black, even, and arcuate, accompanied by a reddish shade; exterior line with a similar shade, black, dentate opposite the reniform spot, below which it is sharply drawn in, nearly touching the base of the spot and then continuing obliquely to the inner margin; reniform spot consisting of an inner straight line followed by a round black spot; orbicular spot absent; subterminal line whitish and irregular; fringe whitish at the apex and inner angle, otherwise nearly concolorous.

Posterior wings bright scarlet, with a very heavy black quadrangular discal spot, a subterminal line, broken in the middle, and a terminal band, becoming obsolete before the anal angle.

Beneath the anterior wings are whitish, with the basal space slightly red, a heavy oblique transverse black median line, touching below a rounded subterminal band, this is followed by a heavy terminal band becoming obsolete before the inner angle; posterior wings the same as above, but the costa is white instead of scarlet.

Hab. Dallas, Texas (Boll).

From the Museum of Comparative Zoology.

This species is allied to *S. howlandi*, Grote, from Colorado, but differs in important particulars.

Homoptera galbanata, nov. sp.

Expanse 38 mm. Length of body 15 mm.

This is a small species closely allied to *H. edusina* from Texas, described by Dr. Harvey.

I have compared the present species with specimens of the latter in the Museum of Comparative Zoology, and find them distinct. In *galbanata* the middle abdominal tuft is much larger than the others, the whole insect is also larger, its color more uniformly gray, and the ordinary undulating transverse lines differ in their intensity and course from those of its ally.

Head and thorax gray, faintly mottled with white and black.

Tegulæ shaped as in related species, wings gray, covered by numerous dark gray undulating lines; basal space dark gray, interior line oblique, between it and the exterior line two undulating lines, one of which passes before, the other around the distinct reniform spot; exterior line black and well defined, forming a prominent indentation opposite the reniform spot; the terminal and subterminal lines followed by slight dull yellowish shades; markings of the posterior wings corresponding to those of the anteriors, except that the basal lines are absent and that there are two black subparallel median lines, most prominent at the anal angle.

Beneath gray, with distinct discal dots and a common black median line (in this respect differing from the Texan species).

Hab. Glencoe, Nebraska.

From Mr. G. M. Dodge (No. 48).

NOVEMBER 2.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-eight members present.

Natural Hybrids. Quercus heterophylla, Mx.—Mr. THOMAS MEEHAN said, that in reference to the minutes of the last meeting just read, he might offer a few additional remarks on *Q. heterophylla*, and its connection with *Q. Phellos*. It was a subject of much interest equally to the mere botanist, the student of the origin of species, and to those who were investigating the frequency or otherwise with which hybrids occurred in nature.

He doubted, he said, whether hybrids often occurred naturally, and yet with the supposed abhorrence of plants to use their own pollen, and the consequent invitation which they extended to foreign pollen to fertilize them, it would be remarkable if some instances of hybridism did not occur, and perhaps remarkable that it did not occur oftener than it was supposed to do. It was such questions as these which gave the supposed hybrid origin of this oak its chief interest. In this connection he referred to the number of the *Revue Scientifique* then on the table, with an abstract of some remarks of M. Ch. Naudin before the Academy of Sciences of Paris, in which he says, that, of a large number of cases of hybrids that he had experimented with, only two retained their hybrid forms beyond two generations, and these two, grasses of the genus *Ægilops*, lost their respective forms, and reverted to that of the original female parent in four generations.

Mr. Meehan said that the original tree described by Michaux grew on the original Bartram estate. That tree had long since been destroyed; but there were now large trees, both at Bartram's and Marshall's, which were said by the late Col. Carr, who had married Miss Bartram, and up to comparatively recent years owned the garden, to be seedlings from that original tree. If this were correct, it would sustain Naudin's views, as these trees were so like the willow oak as to be scarcely distinguishable. They only differ from the willow oak, in an occasional lobing of the leaf, a matter of little consequence in determining a species in this genus. It is more than likely, for reasons he would presently state, that William Bartram found young plants with lobed leaves growing, and transplanted them to his garden, believing them to have been seedlings of the *Q. heterophylla*, and not that they were from seed actually gathered from the tree.

In his description Michaux speaks of it as probably having *Q. imbricaria* for one of its parents, but there is no proof nor probability that this species ever grew in these parts. It could not then be considered in this relation. Moreover, hybrids, which cannot necessarily be abundant in nature, or there would not be the order we see, seldom come in more than one place, or if so, be exactly alike, and yet investigation shows this form to be by no means uncommon. Michaux rashly undertakes to say that there is not another tree to be found within a hundred miles of Philadelphia, yet Professor Buckley found one in a single day's botanizing in New Jersey near Camden, as recorded in our Proceedings; he had himself found it during one day's botanizing in Delaware as recorded in Gray's manual. Professor Leidy, Mr Smith, Mr. Cope, and Mr. Burk have found it in New Jersey, and there were now on the table specimens gathered by the latter gentleman near Woodbury, who had found two trees on this occasion, and had seen quite a number on other occasions. There is no doubt that when these casual visitors meet with trees, there is no great scarcity, and this is not in accordance with what we have to expect from hybrid trees.

Now as we see in these specimens of Mr. Burk, as well as in the original drawing in Michaux, the venation is wholly distinct from *Quercus Phellos*, and *Q. imbricaria*, and it is here that we find the best characters for distinguishing the species of oak. There is a petiole nearly an inch long in these specimens, and also in Michaux's drawing, and more or less of a petiole in all the specimens he had seen; and, while the leaves of the *Q. Phellos* are thin, those of *Q. heterophylla* are coriaceous. A hybrid unites the characters of two parents, but there were no two parents here in the North which could unite and form a character like this, and so the supposed Bartram and Marshall progenies are out of the question.

In the monograph on *Cupuliferæ* by Alphonse De Condolle in the *Prodromus*, this oak is made a form of *Q. aquatica*. This suggestion, misled by the probably historical error in regard to the living Bartram tree, he had regarded as preposterous, and he believed most North American botanists had agreed with him. The forms of leaf most familiar to Quercologists, in *Quercus aquatica*, were the triangularly wedge-shaped, nearly sessile ones, common in the South on mature trees. But further north, and in young and vigorous trees south, the leaves were petiolate, approaching those now exhibited by Mr. Burk. Besides this there was in Michaux's figure an outline of one of these forms of leaves, which one could see by comparison with his figure of *Q. heterophylla* to be the same. The habit of growth of the trees of *Q. aquatica* is very distinct from that of *Q. Phellos*, and Mr. Burk reports these trees in New Jersey to be so distinct from the *Q. Phellos* among which they grow, that he can distinguish them a long distance away. The only remaining difficulties to students would be that De Candolle classes *Q. aquatica*, variety *heterophylla*, among the "*sempervirentes*," while we know it is deciduous, and then that it is a too high northern range for this species. The first difficulty he could dispose of. He had had in his garden for a number of years a *Quercus aquatica* from seed gathered near Vicksburg, where it was evergreen. But with him the same tree was deciduous. In regard to the range, De Candolle noted on the authority of Michaux that it grew in Maryland, and Mr. Canby reports it common in Delaware. This brings the range of the species up to our doors.

It is therefore clear that *Quercus heterophylla* is simply an outpost in the camp of *Quercus aquatica*, barely indeed ranking as a variety; and the result of our investigation is a tribute to the remarkable acumen of Alphonse De Candolle, who, with so little material before him, was able to guide us who had it all.

Hybrid Juglans.—Mr. Meehan, continuing his remarks on natural hybrids, exhibited a fruit from a tree growing near Meadville, Pennsylvania, and handed him by Alfred Huidekoper of that place. The fruit was of the oval form of *J. cathartica* (Butternut), but had the comparatively smooth surface of *J. nigra* (Black walnut), and was quite destitute of viscous glands. It was believed to be a natural hybrid between these two species.

Hybrids of Pyrus Sinensis.—Not exactly as natural hybrids, continued Mr. Meehan, but yet as hybrids without intention by man, were some pears he now exhibited, raised by Mr. Peter Kiefer of this place. For near twenty-five years Mr. K. had grown the *Pyrus Sinensis*, or Chinese sand pear, and for some years past had been fruiting seedlings from the original tree, and these have fruit uniformly the same as its parent, and as they seem to do in other parts of the world. Mr. Meehan exhibited a fruit and compared it with a figure in a recent number of the *Gardener's Chronicle* of London, then lying on the table, the two as similar as if the specimen had been used as copy for the sketch. Some years ago a Flemish beauty pear, a well-known variety of our common garden fruit, had flowered in close proximity, and since then pears mixed in character had been raised from this supposed to be hybrid seeds. The specimens exhibited by Mr. Meehan were much larger than the sand pear, the female parent, and as large as the average Flemish beauty of our markets; the red cheeks, and fine lemon color, being rather more beautiful than the average of Flemish beauty, though this kind is popular as a particularly handsome fruit.

NOVEMBER 9.

Dr. LeConte, Vice-President, in the chair.

Twenty-three members present.

A paper entitled "On a New Genus of Lophobranchiate Fishes," by Edw. D. Cope, was presented for publication.

NOVEMBER 16.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-seven members present.

The following papers were presented for publication:—

"Descriptions of New Fossil Shells from the Tertiary of California." By R. E. C. Stearns.

"A Descriptive Catalogue of Scalidæ of the West India Islands." By O. A. L. Mörch.

On Trichocephalus affinis, Dies.—Dr. CHAPMAN noticed having found in the intestine of the llama the *Trichocephalus affinis* described by Diesing as occurring in the camel, and observed that it was interesting to find the same intestinal worm in animals so closely related structurally, though so widely separated geographically.

On the Castor Glands of the Beaver.—Dr. CHAPMAN also called attention to the arrangement of the castor glands in the American beaver, the lower symmetrical glands opening into the ano-preputial passage consisting of only two glands, whereas the European species in this respect exhibited three.

NOVEMBER 23.

The President, Dr. RUSCHENBERGER, in the chair.

Seventeen members present.

On the Mesozoic Red Sandstone of the Atlantic States.—Prof. PERSIFOR FRAZER, Jr., said that the art of stratigraphy has proved itself capable of most wonderful extension, and has given the foundation for whatever of exactitude of statement can be claimed for geology.

It is another instance of the surprising lengths to which probability can be carried by inductive reasoning based on comparatively few but generally admitted premises. It is surprising to read over the results of the application of this method in any general outline of geology, and to note that mere relative position of things can unfold to us a marvellous story of motion, and evolution or successive changes, according to law.

The more facts we know the wider is the range of this application, and sometimes one very little fact well established will require vast continents to be plunged in the imagination thousands of feet downward or upward in order that it may admit of explanation. Thus the finding of a single small shell imbedded in the crest of a lofty range of interior mountains of which the base, flanks, and comb prove to be made up respectively of the same persistent strata, and the identification of this shell with an exclusively marine species, require the conclusion that the whole of this lofty range was once under an ocean whose level was thousands of feet lower, and whose margin is now thousands of miles away.

The greatest conquests of the mind over large areas will never result from the direct application of the physical power of man to overcome the obstacles which stand in the way of their realization. The inductive plan, though never leading to certainty, outstrips by leagues the snail's pace of actual demonstration. A good consulting geologist will furnish information in a few weeks as to the number of tons of valuable mineral on a property, which will enable a company to organize, start its business, grow rich, and bequeath its industry to a new generation before a theory-hater could sink the number of trial shafts sufficient to demonstrate to a certainty that the deposit was continuous. And thus what with reports already made on adjoining properties, science goes on triangulating, as it were, from one area to another, till the belts of country which are unknown as to their general possibilities become very few and isolated.

But there are such belts—aggravating broad belts of well-settled country which occupy in the geological finished map the positions which used to be held by the "Great American Desert," the central parts of Africa, and the high lands of the Mountains of the Moon or the Himalayas in our school geographies.

It is not so long ago since it was taught in school-books that the bottom of the ocean was a great floor of fine sand. The writers, following each other, had observed the deposition of suspended substances in the deltas and along the sea coast, and observing the currents of the sea, and forgetting that the immense organic life of the ocean must find a final resting place, had dusted the whole ocean with the sand of the sea-shore but without its shells.

Such an area is the Mesozoic red sandstone of the Atlantic States. It sweeps upward from Virginia to New York, and exists in North Carolina and Connecticut, appearing everywhere (except in N. C.) under a provoking uniformity of condition, and shutting out our view from the underlying strata, and the part they play in connecting the paleozoic series east and west of it. Singularly enough, a large fraction of the American geologists who have made themselves distinguished have passed or are passing their lives upon it; and yet we know next to nothing about it.

"If the Mesozoic shales *only* could be removed like the lid of a box, what light would it not throw upon the structural riddles!" has been thought or expressed by every geologist. Here is a case where the ordinary methods of stratigraphy will not help us.

We are required to induce a condition of things under cover different from that in view.

The case is like that of the condition of the Atlantic bottom. No amount of wishing, in cottages by the sea (*aut aliubi*) availed to solve the problem till Lieut. Thompson, U. S. N., invented his deep-sea dredger, and masses of cretaceous ooze commenced to be hauled up. We must do the same with the diamond drills in the New Red. But it paid to dredge because this act was a necessary preliminary to the union of two impatient continents by a telegraph line. What will pay here? That is a question which no one can answer just now. It is just an instance of the old controversy between narrow utilitarianism and enlightened economy: whether a property owner is wise in neglecting all parts of his estate except those which tradition assures him will pay, or whether, in the profit and loss account in which he enters general expenditures for the proper exploitation and development of his entire domain, the profits do not in the end outweigh the losses.

Here, of course, another element is introduced into the question. Is there any doubt about the establishment one way or the other of a fact which will enter into scientific calculations? Was ever such a fact so used barren of economical gain in the end? Will it pay for the State Government to spend the money of the whole people for such a purpose? Is it in accordance with the doctrine of "police government" held by an able school of advanced political economists?

On Dialysis in Oyster Culture.—Prof. FRAZER also remarked, that, in a recent conversation with Dr. Hunt on the subject of the effect of saline solutions in the human stomach and intestine, that gentleman suggested as his explanation of that effect, that it was primarily mechanical or physical; consisting in fact of a dialytic action set up between the denser solution in the stomach, and the less dense solutions in the tissues and lacteals communicating with it; the walls of the stomach and intestine forming the dialyser or diaphragm through which the action takes place. The result of such diffusion must (he suggests), in accordance with Graham's well-known law, produce a greater flow of the less dense solutions inward than of the denser outward from the stomach; and as a consequence, the filling of the latter and the draining of the small ducts.

That repletion produces, by reflex action on the nerves occupying that portion of the human body, the further effects observed, is well known.

There is another practical application which can be made of this theory of dialytic action, no less important in its bearings, and which has an economic value, viz., the fattening of oysters.

The oysters brought to our large markets on the Atlantic seaboard are generally first subjected to a process of "laying out," which consists in placing them for a short time in fresher water than that from which they have been taken.

Persons who are fond of this animal as an article of food, know how much the "fresh" exceed the "salts" in size and consistency. The "Morris Coves" of this city, while very insipid, are the plumpest bivalve brought to market. On the other hand, the "Absecoms" and "Brigantines," while of better flavor (to those who prefer salt oysters), are invariably lean compared to their transplanted rivals, as also are the "Cape Mays," though, from some reason, not to the same extent.

The most experienced oyster dealers inform me, that the time for allowing the salt oysters taken from the sea-coast to lie out, varies, but is seldom over two to three days. At the end of this time the maximum plumpness is attained, and beyond this, the oyster becomes lean again, besides having lost in flavor.

It is not possible that the smooth rotundity of the laid-out oyster can be due to increase of flesh. The time is too short, and the conditions are unfavorable.

On the other hand, the explanation by dialytic action is easy. During the growth of the oyster on the sea-coast, his tissues are constantly saturated with the ocean brine. On removing this oyster to merely brackish, or to fresh water, the conditions are at once favorable for osmose to be commenced. The fresher and less dense liquid without, permeates inwards more rapidly than the more saline and denser liquids within escape, and the effect is to swell the tissue as a cow's bladder half filled with air and immersed in a vessel of hydrogen is swollen, or still more nearly like the swelling of a bladder half filled with copper sulphate when immersed in pure water.

It is worth while to inquire whether means could not be devised to effect this fattening, while yet not depriving the oyster of the salty flavor which is its chief charm to many consumers. Perhaps an immersion in concentrated brine for several days, and its subsequent removal to ocean water, would suffice. As to the value of placing corn-meal upon a pile of oysters for the purpose of fattening them, it is obvious that the time is too short. A simple way of ascertaining whether there were or not an actual gain in flesh, would be by taking a hundred or more oysters from a given locality on the sea-coast, drying them at 220° Fah., and ascertaining their average weight, and repeating the process for the same number of like oysters after transplanting.

November 30.

The President, Dr. Ruschenberger, in the chair.

Thirty members present.

On Heat and Chemical Action.—Prof. Persifor Frazer, Jr., stated that Prof. Hunt, in chemical and geological essays No. VII, "On Some Points in Dynamical Geology," p. 77, after speaking of his adoption of Babbage's and Herschel's hypothesis of an igneous centre, adds that Kefersbein rejects this hypothesis as unnecessary, and Joseph Le Conte proposes an intermediate view that heat from a molten centre invading the sedimentary intermediate layers may excite chemical activity, which in turn would augment the temperature. He concludes, "it is, however, I think, probable that any chemical processes which may be set up in the buried sediments for their conversion into igneous rocks and volcanic products would absorb rather than generate heat."

The mere conversion of silicates from the solid to the liquid, or, if it be possible, gaseous states, is not chemical action; and hence fusion or vaporization, which undoubtedly would lower the temperature by its great absorption of heat, cannot be referred to here, and it seems at first sight rather difficult to say what form of chemical action—except dissociation, if that can be called such—would absorb heat, or upon what phenomena this statement is based.

On the supposed Carnivora of the Eocene of the Rocky Mountains.—Prof. Cope remarked that animals which fulfilled the functions of the existing *Carnivora* were abundant in North America during the Eocene period. The Wahsatch beds of New Mexico have yielded remains of more than a dozen species, which ranged from the size of a weasel to that of a jaguar. Investigation into the structure of these shows that while they differ in minor points among themselves, they agree in possessing characters which distinguish them from the true *Carnivora*. I have already pointed out,[1] that, in the genera *Amblyctonus*, *Oxyæna*, *Stypolophus*, and *Didymictis*, the tibio-tarsal articulation differs from that of the existing *Carnivora*, and suggested that these forms might prove to be gigantic *Insectivora*. Further investigation has satisfied me that they cannot be included in the order *Carnivora*, and their systematic position proves to be of considerable interest.

A greater or less part of the cranial chamber is preserved in specimens of *Oxyæna forcipata* and *Stypolophus hians*. In these

[1] Systematic Catalogue of the Vertebrata of the Eocene of New Mexico, 1875, p. 7.

animals it has a long, narrow form like that of the opossum, and in the first named, where the interior form can be seen, it is evident that the cerebral hemispheres were small and narrow, and that the olfactory lobes were relatively large, and were entirely uncovered, projecting beyond the hemispheres.

In *Ambloctonus*, *Didymictis*, and three undetermined forms, the femur supports a third trochanter. In all the genera the ilium has a well-marked external anterior ridge, which continues from the acetabulum to the crest, distinct from the internal anterior ridge. The ilium has, therefore, an angulate or convex external face, as in *Insectivora* and *Marsupialia*, and does not display the usual expansion in a single plane of most of the placentals. In all the genera there is a strong tuberosity in the position of the anterior inferior spine, which is wanting in the *Mammalia*, excepting certain *Insectivora* and *Prosimiæ*,[1] although it marks the position of the origin of the rectus femoris muscle in all types.

The glenoid cavity of the squamosal bone is transverse, and well defined anteriorly and posteriorly, as in the *Carnivora*. Of the first series of carpal bones of the four genera named, I have been able to learn nothing, but in the genus *Synoplotherium* from the Bridger Eocene of Wyoming, which probably belongs to this group, the scaphoid and lunar bones are separate and not united as in the *Carnivora*.

The above characters point to the *Marsupialia* or the *Insectivora* as the proper location for the flesh-eaters under consideration; and the evidence is much more weighty in favor of the latter order as their true position. For in the genera *Oxyæna* and *Didymictis* the posterior part of the inferior border of the mandibular ramus is not inflected as in *Marsupialia*, nor are the anterior inferior iliac tuberosity and third trochanter seen in that order, while both exist in the *Insectivora*.

Cuvier describes[2] the tibia of *Carnivora* as follows: "Quant à la tête inférieure, tous les carnassiers se distinguént de l'homme par sa figure plus étroite du côte externe que le l'interne, et par sa division en deux fosses oblique, au moyen d'une arête arrondie qui repond à la partie de l'astragale. . . Le phoque l'a cependant d'une forme très-particulière par l'excessif aplatissement de sa moitié supérieure, et par sa facette particulaire inférieure, qui est en concavité simple et peu profounde."

The astragalar articular face of the tibia in the genera above named is not divided into the two oblique fossæ by "a rounded crest which is applied to the groove of the superior pully-shaped face of the astragalus." It is uninterrupted and more or less oblique in the transverse direction; always so at the posterior border. The inner malleolar process is produced downwards, and rests in a concavity on the inner side of the neck of the astragalus.

[1] See the figure of *Solenodon* by Peters, and *Chiromys* by Owen.

[2] Ossemens Fossiles, vii. p. 112.

The astragalus, which I have seen in several of the species, presents a corresponding trochlear face. That is, instead of a groove, it presents an open angle upwards, which separates the superior from the oblique internal face. The superior plane is flat, but is interrupted on the posterior side by a groove. This groove is the posterior extremity of that which divides the superior face of the astragalus in the higher *Mammalia*, but here it contracts to a point and disappears next the fibular face just as it reaches the superior surface. The fibular face is vertical, and shares on its posterior part a large ligamentous fossa with the opposed part of the fibula. The distal end of the fibula is remarkably stout.

This structure finds its counterpart in the internal half of the astragalus of the opossum. The arrangement permits a rotary movement of the astragalus and thus of the whole foot, on the tibia, the fibula, with its fixed articulation with the astragalus, rotating on the tibia, as in the pedimanous *Marsupialia*. The flatness of the inner malleolus in some of the species indicates that the capacity for rotation was less in them than in others. This arrangement exactly reverses the extensive oblique fibulo-astragalar articulation seen in the opossum, the *Petaurista*, *Dasyurus*, etc. Prof. Owen, in describing the astralagus of the wombat (*Phascolomys*), says: "The upper articular surface for the tibia is as usual concavo-convex, the internal surface for the inner malleolus flattened, and at right angles with the preceding, but the outer articular surface presents a triangular flattened form, and, instead of being bent down parallel with the inner articular surface, slopes away at a very open angle from the upper surface, receiving the articular surface of the fibula so as to sustain its vertical pressure. * * * This form of astragalus is also characteristic of the Koala, Petaurists, Dasyures, and the Pedimanous Marsupialia."

In one species where the cuboid bones are preserved, it is evident that the distal end of the astragalus articulated with this as well as with the navicular bone, although the facet of the astragalus is single and continuous. As the extensive transverse distal astragalar face is characteristic of all the species where it is preserved, the contact of the cuboid and astragalus is probably common to all of this division.

The dentition of this group is consistent with its reference to the sarcophagous *Marsupialia* or to the *Insectivora*. It has, however, decided resemblances in the form of the molars, and in the deficiency in the number of the inferior incisors, to such genera of *Insectivora* as *Mythomys* and *Solenodon*, while in the large canines, it more nearly approaches *Sarcophaga* and *Carnivora*.

I propose to include the genera *Ambloctonus*, *Oxyæna*, *Stypolophus*, and *Didymictis* in a special division under the name of *Creodonta*. This division may be regarded as a suborder of the *Insectivora*. It is possible that the genus *Diacodon* Cope belongs here also; its species resemble *Chiroptera* in the inferior dentition, and are of small size. The genus *Mesonyx*,[1] which I discovered in the Bridger beds of Wyoming, cannot be referred to the *Creodonta* as here constituted, since the trochlear face of the astragalus is completely grooved above as in the true *Carnivora*, and its distal end presents two distinct facets, one for the cuboid and the other for the navicular bones. It represents on this account a peculiar family, the *Mesonychidæ*.

To the *Creodonta* must be referred the genera *Pterodon* and *Palæonictis* of De Blainville, from the French Eocene. This author and Pomel placed them in the *Marsupialia*, but Professor Gervais remarks (Geologie et Paleontologie Française) that the evidence is insufficient for such a course. Here also doubtless belong supposed *Carnivora* from the Wyoming Eocene, stated by Marsh to be allied to the *Viverridæ*.

The remarkable type first introduced to the notice of paleontologists by Leidy, represented by the genera *Anchippodus*, *Ectoganus*, etc., has been looked upon as an order of *Mammalia* by Marsh, and termed the *Tillodontia*. He gives,[2] as its characters, the possession of claws, plantigrade feet with five toes, a third trochanter of the femur, and separate scaphoid and lunar bones. Also, that the dentition is characterized by "molars of the ungulate type," small canines, and large scalpriform incisors in both jaws, faced with enamel and growing from persistent pulps as in the *Rodentia*. He says this order "seems to combine characters of the orders of carnivores, ungulates, and rodents."

Except in the dentition, the definition above given applies to the *Creodonta*; and an analysis of the dentition shows so many points of resemblance as to render it probable that they pertain to the same order of *Mammalia*. Also, except in the dentition, the characters given by Prof. Marsh do not differ from those of the *Insectivora*. The structure of the superior molars is not inconsistent with the same order, and the small canines and large incisors are even more like those of most *Insectivora* than are *Creodonta*. The singular form of these incisors, and their growth from persistent pulps, is rather characteristic of *Rodentia*. The transverse or tubercular premolars also distinguish this group from both the *Creodonta* and the true *Insectivora*. The definitions of the order and sub-orders will then be as follows:—

INSECTIVORA.—*Mammalia* with small cerebral hemispheres which do not cover the olfactory lobes, nor the cerebellum; with numerous clawed digits, and a third trochanter of the femur; with a transverse glenoid cavity for the mandible.

Superior incisors normal, not growing from persistent pulps; canines large; premolars compressed. Astragalus not grooved above, articulating with the cuboid as well as the navicular; five toes on the hind foot; *Creodonta*.

[1] Ann. Rept U. S. Geol. Surv. Terrs., 1872, p. 550.
[2] Amer. Journ. Sci. Arts, 1875, 231.

Superior incisors large, growing from persistent pulps, and without enamel on the sides; superior canines small when present; premolars wide or tubercular; *Tillodonta.*

These suborders of the order *Insectivora* do not differ among themselves more than do those of the *Marsupialia*, and constitute a series of parallels with them. Thus the *Creodonta* resemble the *Sarcophaga*, the *Insectivora vera* the *Entomophaga*, and the *Tillodonta* the *Rhizophaga*, typified by *Phascolomys*.

The genera of the *Creodonta* differ as follows:—

I. First and third inferior true molars without internal cusp. Last superior molar longitudinal; last inferior molar carnassial; *Amblyctonus.*

II. Inferior carnassials with interior tubercle; no tubercular molar; last superior molar transverse.

Three tubercular carnassials;[1] *Stypolophus.*

Two tubercular carnassials; *Oxyæna.*

III. Inferior carnassial with interior tubercle; a tubercular molar.

One tubercular carnassial; *Didymictis.*

The number of toes on the hind foot cannot be certainly stated in all the genera, but in *Stypolophus hians* and another species there were probably five, the inner being of reduced size. There is present in those species an ento-cuneiform bone which resembles that of *Canis;* it is compressed, with one truncate concave terminal facet, and an internal oblique one at the opposite and proximal extremity. The form of the truncate articular face of the distal end indicates the existence of an inner metatarsal bone of moderate proportions, which probably supported a small hallux. This thumb could not be opposable as in the opossum.

In general appearance the *Creodonta* differed from the *Carnivora*, in many of the species at least, in the small relative size of the limbs as compared with that of the head, and in some instances, as compared with the size of the hind feet. The feet were probably plantigrade, and the posterior ones capable of some degree of rotation. The probable large size of the rectus femoris muscle indicates unusual power of extension of the hind limb. They were furnished with a long and large tail. Probably some of the species resembled in proportions the *Mythomys* and *Solenodon*, now existing in Africa and the West Indies, but they mostly attained a much larger size.

J. B. Knight, Elliston P. Morris, R. Shelmerdine McCombs, M.D., John C. Boyd, M.D., U. S. N., and Eli K. Price, Esq., were elected members.

Prof. William Henry Flower, F.R.S., of London, Dr. Albert

[1] For the meaning of these expressions, see Syst. Cat. Eoc., New Mexico, 1875, p. 6.

Günther, of London, Prof. St. George Mivart, F.R.S., of London, N. S. Maskelyne, F.R.S., of London, and Prof. George Rolleston, F.R.S., of Oxford, were elected correspondents.

The Committee, to which was referred a paper entitled "A Descriptive Catalogue of Scalidæ of the West India Islands," by Dr. O. A. L. Mörch, reported in favor of its publication in the Journal.

The Committees to which they had been referred recommended the following papers to be published:—

ON A NEW GENUS OF LOPHOBRANCHIATE FISHES.

BY E. D. COPE.

Osphyolax pellucidus, gen. et sp. nov. Plate 25.

Char. Gen.—Pectoral fins wanting; tail subcylindric. Body covered with thin, weakly keeled scuta, which have on the lumbar region free superior edges, which form a series of longitudinal lateral grooves. The lateral dorsal scuta produced upwards, and approximated on the middle line, inclosing a tube for a distance anterior to the dorsal fin. Dorsal fin short, above the vent. No ventral nor caudal pouch; caudal fin rudimental in the typical species. No adipose fins.

This genus is related to *Nerophis*, but is different from known forms in its curious dorsal tube. What the purpose of this can be is uncertain, but the strong lateral channels below it on each side, are probably an adaptation for the carrying of the eggs. In the type species, the dorsal tube is closed above by a series of small radiate ossicles in the median line, between which the cavity may be entered by small bodies. The same specimen displays a narrow, free, dermal membrane on the middle lines of the upper and lower surfaces from the thoracic to the beginning of the lumbar region.

Char. Specif.—Three longitudinal series of scuta on each side of the body, and one on the middle line below. They are rounded at the intersecting angles, thus leaving a vacancy, which is covered by a small, round scale. Each scute with a low median keel, from which delicate transverse ridges diverge. The two lower lateral series are the ones which form the lumbar grooves. Two nuchal scuta. Parietal and frontal regions impressed punctate; operculum radiate; sides of muzzle smooth. Thirty-one transverse rows of scuta. Dorsal radii sixteen. Total length .232 m.; length to vent, .117; to edge of operculum, .020; to orbit, .010. Color in spirits pellucid, the back tinged with brownish.

Obtained by Captain J. Mortimer in the open Atlantic Ocean.

EXPLANATION OF PLATE.

Fig. 1. *Osphyolax pellucidus.*
" 2. Head of the same from above.
" 3. Dorsal line in front of dorsal fin.
" 4. Lateral lumbar region.

DESCRIPTION OF A NEW SPECIES OF BIRD OF PARADISE OF THE GENUS PTILORIS, IN THE COLLECTION OF THE ACADEMY.

BY J. A. OGDEN, M.D., PH.D.

Ptiloris Wilsonii. Plate 25.

Top of head, occiput, throat, upper part of the breast, extending around beneath the eyes, of a shining, metallic, purplish-green color; the lower margin of the metallic colored feathers of the breast is marked with a line of purple and light-green feathers, the latter blending with the purple colored feathers of the abdomen; entire upper parts velvety-green, with purple reflections; the two central tail feathers metallic green, the rest black with the outer margin shaded with purple; the wings black, with the outer border purplish.

Total length (mounted specimen), 14″; bill 2″ 3‴; wing 5″ 4‴; tail 4″ 2‴; tarsus 1″ 4‴; middle toe 1″ 1‴.

Hab. New Guinea.

This species is larger than either *P. magnificus* or *P. Albertii.* The metallic colored feathers are larger, and extend over a greater surface of the throat and breast; the lower border is rounded. The tarsi are shorter, and the toes not so stout as in the above two species.

This constitutes the fifth species of the genus, and I have named it in honor of the donor and esteemed naturalist, Dr. T. B. Wilson.

OBSERVATIONS ON THE STRUCTURE OF THE MANATEE.

BY HENRY C. CHAPMAN, M.D.

Although in 1872 there appeared in the Transactions of the Zoological Society of London a most admirable paper "On the Form and Structure of the Manatee," by Dr. Murie, as I have been lately engaged in the dissection of the Manatees, Manatus Americanus, that died at the Zoological Garden of Philadelphia, and as I believe this is the first time that the opportunity has presented itself of studying fresh specimens, I think it not superfluous to call attention to some of my results. As that excellent anatomist, Dr. Murie, has very fully illustrated the anatomy of the Manatee in the paper just mentioned, and refers frequently in it to the literature of the subject, I shall limit myself to either confirming his observations save in some points, or endeavoring to supplement what is wanting in his paper, as, his specimens having been opened on shipboard, some of the parts were thereby either injured or decomposed, rendering them unfortunately unsatisfactory for dissection.

The Position of the Manatee in the Animal Kingdom.—I agree with most naturalists in considering it and the Dugong as the representatives of a distinct order, the Sirenia, regarding their geographical distribution, food, structure of the skin, skeleton, position of the nares, and mammæ, the organs of alimentation, circulation, the uro-genital apparatus, as entirely separating them from the Cetacea, with which they were combined by Cuvier and are still by Profs. Hæckel, Carus, etc. While in some respects the Sirenia are undoubtedly akin to the Pachydermata, De Blainville likening them to the Proboscidea, others to the Hippopotamus, in the present state of Biology I think it impossible to indicate the exact relationship, there being no transitional form to bridge over the gulf as the Zeuglodon does in the case of the Carnivora and Cetacea, and so provisionally it appears to me that the order Sirenia must be preserved.

Sex, Length of Animals.—The animals dissected by me were both males, one measured exactly 6 feet from snout to tip of tail, the other $6\frac{1}{2}$ feet. Their general appearance, the color of the creatures, character of the skin and hair, etc., were illustrations of the truthful description given by Dr. Murie.

Osseous and Muscular Systems.—As regards the osseous system I have nothing new to offer, merely observing that I found only 6 cervical vertebræ, and that I agree with Dr. Murie in regarding the 3d cervical as the missing one. To those interested in the Myology of the Manatee, I would refer them to the paper of Dr. Murie, where good comparisons are made between its muscles and those of the Elephant and Cetacea. Plate 21, however, does not give exactly the color of the muscles as observed in my specimens, which were rather redder than the brownish tint there depicted.

Nervous System.—Of the many subjects in anatomy for future investigation, perhaps none surpasses in interest or importance a thorough study of the Sirenian brain, not only in reference to the completing our knowledge of the structure of the Sirenia, but as offering additional data for the determination of their relative position among the other Mammalia. At page 180 of his paper, Dr. Murie states that "the encephalon of the younger male was so destroyed as to be unfit for examination; while the membranes surrounded the brain of the female specimen, a tolerably accurate idea of the cerebral contour was got; but on raising the dura mater, the brain itself was found to be softened and with difficulty extracted. No measurements or weight were taken, but the whole placed in spirit as rapidly as possible; a cast of the cranial cavity with its inclosed dura mater was subsequently made, and by the help of the cast and the shrunken brain, the sketches were drawn." Such being the state of the brain in Dr. Murie's specimen, I took the earliest opportunity of examining those of mine. As the brain in my smallest Manatee seemed to have suffered from some compression affecting the symmetry of the anterior lobes and somewhat flattening them, I used it for making sections, keeping the brain of the largest Manatee, which was quite normal and in excellent condition, for description externally. From the latter specimen the figures (Plate 26) have been drawn. After removing the dura mater, which was very tough, what at once struck me, on looking at the brain *in sitû*, was the absence of either numerous or deep fissures and folds. The elevation of the cerebellum as compared with that of the cerebrum (not so well seen after removal from the skull) is greater than that figured by Dr. Murie, the amount of the cerebellum left uncovered by the cerebrum is more considerable. The brain as a whole resembled somewhat that of a beaver or porcupine, the general figure of the cerebrum being more Rodent-like than "Elephantine," as Dr. Murie describes that of his specimen at p. 181; but in truth, taking it all in all, the brain of the Manatee is *sui generis*, not looking like any brain I have dissected, seen preserved, or figured. Dr. Murie, at p. 183, refers to some figure of the Dugong's brain, but as he gives no reference and as I know of no such figure, I cannot make any comparison. The general figure of the cerebrum is quadrangular, but rounded off at the corners, as Dr. Murie expresses it, the lobes sloping gently downward from before backward. The height of the cerebrum in profile in the middle of the anterior lobes is $2\frac{1}{2}$ inches, the length of cerebrum 3 inches, the breadth through middle lobes $3\frac{1}{4}$ inches. The height of the cerebellum is $1\frac{5}{8}$ inches. The difference between the height of the cerebrum and cerebellum is less therefore than that of the brain represented by Dr. Murie.

As regards the cerebrum, I had no difficulty in recognizing frontal, parietal, temporal, and occipital lobes, the frontal lobes being enormous. The hemispheres are separated by a deep longitudinal fissure; equally striking is the Sylvian fissure dividing each hemisphere into an anterior and posterior half. As regards the remaining fissures and folds I cannot say that I found them as well marked as those represented by Dr. Murie in Figs. 31, 32, Plate 25. Indeed the smoothness of both the brains examined by me is most remarkable. I identified, however, the fissures of Rolando, the Hippocampal and the Calloso Marginal. I refrain from naming the remaining ones, as I am not satisfied as to their homologies with those of the brains of other Mammalia. The olfactory nerves are of good size, with well-developed bulbs. This is in harmony with their sense of smell, which I think is acute, having noticed with Mr. Thompson, Superintendent of the Garden, that the Manatee seemed to recognize at once that its food had been put in the aquarium by its sense of smell rather than by its sight or hearing, which were apparently rather defective. The optic nerves are small. The pituitary body is large, but the corpora albicantia are not well differentiated. The 3d pair of nerves are of fair size. What I took to be the 4th is a very delicate filament. The 5th is relatively and absolutely very large. If Dr. Murie has correctly described the 6th, its origin, direction, and size are very peculiar. It is possible, however, that the 6th is absent in the Manatee, as I found no trace of it at its usual origin. If such is the case, I should regard Murie's 6th nerve as the 7th, and his 8th as the pars intermedia; his 7th would then be 8th. I was unable to trace out these nerves, being anxious to take out the brain as soon as possible. The glosso-pharyngeal, pneumogastric, and spinal accessory were readily recognized. The hypoglossal came off internally and above the position represented by Dr. Murie in Fig. 33, Plate 25. On making sections I found the corpus callosum extending but little posteriorly; the fornix was well developed, particularly the posterior part. The lateral ventricle is long and deep, the anterior and middle corner very apparent, while there is a beginning of a posterior one. The corpus striatum is well developed, as also the thalamus opticus. There is a delicate tænia semicircularis. The choroid plexus is rich. The hippocampus major is present, but not as thick relatively as the hippocampus minor. There is apparently a corpus fimbriatum. The velum interpositum was well injected, and on removal revealed the pineal gland with its peduncle. The 3d ventricle is deep. The corpora quadrigemina are large, but are really bigeminal bodies, there being only a slight indication of division into nates and testes. The processui e cerebello ad testes are well seen, supporting a firm valve of Vieussens, under which a bristle readily passed from the 4th to the 3d ventricle. The cerebellum is higher, as I have already mentioned, and broader than that represented by Dr. Murie, almost as broad as the cerebrum, its breadth being 3 inches. I noticed in its vermiform process, the floculus and the amygdaloid bodies. The pons and medulla are both flat, but the olivary and restiform bodies are, however, distinguishable. The brain weighed 7 ounces 14 drachms av. In reference to the distribution of the cranial nerves I have nothing new to offer. As regards the cervical plexus, I found its disposition to be the same as described by Dr. Murie, noticing the interesting peculiarity of the 3d and 4th cervical nerves, emerging together from between two contiguous vertebræ, viz., the 2d and 4th. The missing vertebra I regard, with Dr. Murie, as being the 3d. For since the 8th cervical nerve, contributing to form the brachial plexus, escapes from between the 1st dorsal and a contiguous vertebra, which must, therefore, be the 7th cervical, and as the 7th, 6th, and 5th cervical nerves emerge from between contiguous vertebræ, which must for the same reason be the 7th, 6th, and

5th cervical vertebræ, the vertebra next to the 5th must be the 4th, for if it were the 3d, then the 4th and 5th cervical nerves would escape together, instead of the 3d and 4th, the atlas and axis, from their characteristic forms, being unmistakable. As regards the brachial plexus and nerves of the upper extremities, I have nothing new to offer.

Alimentary Apparatus.—As regards the parotid, submaxillary, and what Dr. Murie considers as sub-lingual glands, I have nothing further to say; inasmuch, however, as that writer states at page 170, "that the stomach had been cut open and the contents removed," I may mention that I found the stomach as well as the intestines in both specimens more or less filled with the partially digested fresh-water plants, principally Valesneria spiralis, upon which the animal had been feeding, and that the compound stomach of the smaller Manatee measured in its greater curvature 18½ inches, in its lesser curvature 15½. In reference to its division into cardiac and pyloric portions, the number and shape of its pouches, the œsophageal sphincter, I have nothing to add to what has already been described. As my smallest Manatee measured exactly 6 feet, while the largest of Dr. Murie's was 65 inches, it was to be expected that the intestines in my specimens would be longer than in his. While the small intestine in his specimen was 25 feet long, in mine it was 33 feet 4 inches, the average diameter was about 1 inch. The cæcum in the smallest specimen was 5 inches long, measuring from a point midway between the teats, and 6 inches wide. The teats themselves exhibited the usual conical form, and were 5 inches in length. The large intestine in my smallest specimen gave me a length of 27 feet 2 inches; that of Dr. Murie, male and female, 18 and 17 feet respectively, average diameter in mine was $1\frac{2}{8}$ inches.[1]

At page 173 Dr. Murie states "that the liver of the larger specimen had been hacked in pieces," but that "in the younger male this gland was more intact," and a few lines below observes that "the entire liver has great resemblance in shape to the inflated lungs of an ordinary mammal." I think this comparison a very good one, not only as regards the general form but also in the color, which was quite lung-like. The form of the liver differed

[1] The large intestine of the largest Manatee was filled with parasites representative of the Amphistomum fabaceum of Diesing.

but little from that of the Dugong as described by Prof. Owen. The gland *in situ* extended completely across the abdominal cavity, and measured in the smallest specimen from edge of right lobe to that of left 14 inches; the breadth of the right and left lobes was respectively $7\frac{1}{2}$ and $6\frac{1}{2}$ inches, their depth fore and aft 8 inches and 7 inches. The liver in the smallest specimen weighed 2 pounds $14\frac{1}{2}$ ounces av. I have nothing to add about the gall-bladder save to notice its presence. The pancreas, $6\frac{1}{2}$ inches long, was much lobulated, and, as Dr. Murie states, pale but firm in consistence. Ductus communis choledochus in both my specimens opened into intestine close to the pylorus, while the pancreatic duct opened $1\frac{1}{2}$ inches from the ductus communis. This disposition is different from that noticed by Dr. Murie, he stating at page 173, in speaking of the pancreas, "its duct opens into the intestine close to the pylorus," while at page 174 he says "the ductus communis choledochus penetrates the intestine about 3 inches from the pylorus."

Dr. Murie does not refer to the spleen. I found it in its usual position, but was struck with its very small size, it measuring in the smallest animal only $2\frac{1}{2}$ inches long and 1 inch wide. In form it was oval and of the usual color. Unfortunately the spleen of the Sirenia sheds no light which will help to clear up the difficulties which envelop any explanation of the general physiology of this organ. Its small size, as in the Cetacea, is not in harmony with the idea of its being either the birthplace or the grave of the red corpuscles (which in the Manatee I noticed were very numerous, though in other respects they presented nothing peculiar), while it is in direct contradiction with the theory held by some physiologists of the organ holding blood as a sponge to be pressed out by the distended stomach when needed in digestion.

Respiratory Apparatus.—As the peculiar disposition of the diaphragm and the characters of the respiratory organs generally have often been described, I will limit myself here to simply giving measurements. The trachea of the smallest specimen was 4 inches long from the larynx to where it bifurcates. The right bronchus measured 6 inches in length, the right lung 25 inches, the left bronchus 5 inches, the left lung 27 inches. The bronchi in my specimen are more oblique than as represented by Dr. Murie. I have nothing new to offer in reference to the larynx. I noticed the usual muscles were well developed.

Circulatory Apparatus.—As my smallest specimen was very well injected by Mr. Nash, the preparateur of the University Museum, I took interest in comparing the great bloodvessels and various rete mirabile with those described and handsomely figured by Dr. Murie, and found his account a very satisfactory one I must state, however, that the rete mirabile, figured by Dr. Murie in Plate 24, Fig. 30, as lying immediately underneath and alongside of the trachea and upper portion of the bronchi, was absent in my specimen. I cannot attribute this difference to want of the vessels being filled in my specimen, as the other rete, such as the cervical, cranial, spinal, axillary, brachial, thoracic, intercostal, caudal, etc., were well injected, so that without questioning the correctness of Dr. Murie's plate as illustrating his dissection, I simply state that in this respect it does not give exactly the idea of mine. As Dr. Murie gives measurements of the bifid heart when empty, I offer the following as the size of that organ when distended with the injected material: Width of heart through auricles, measured across aorta and pulmonary artery, 7 inches; the width of aorta was a little over an inch, that of pulmonary artery $1\frac{1}{2}$ inch; width of heart through ventricles $6\frac{1}{2}$ inches. It is interesting to notice the presence of the two superior venæ cavæ, the right one opening into the auricle above, the left one below.

Uro-genital Apparatus.—Among the striking differences that the Sirenia offer as contrasted with the Cetacea, none deserve more notice than the urinary and generative organs. As is well known, the kidney in the Cetacea is much lobulated, whereas in the Manatee no trace of such lobulation is perceptible. The kidneys in the smallest Manatee dissected by me were 6 inches long and 3 inches wide; the ureters of the same diameter throughout measured 10 inches in length from bladder to pelvis. As the male generative organs have been described, and partly figured by Vrolik, I merely mention that the penis in my specimen measured 12 inches in length, and that the ischio cavernosus, bulbo urethræ, and retractor penis muscles were well developed. The seminal vesicles which are absent in the Cetacea were 2 inches long in my specimen. The vas deferens from point of union with duct of seminal vesicle to epididymis measured 8 inches; the testicle, 3 inches long, was somewhat indented, giving the gland the appearance of consisting of two or three bodies.

Habits of the Manatee.—A great disideratum for a long time in every Zoological Garden has been a Manatee, and as the opportunity of studying them living in confinement has presented itself for the first time anywhere, I think it important to call attention to the manner in which the curious creatures were brought to the Zoological Society of Philadelphia, their habits while living there, and the cause of their death as far as I could learn. I am indebted to Mr. Thompson, Superintendent of the Garden, for the use of his daily diary, from which most of the following facts are taken. The two Manatees were brought from Demerara in separate wooden tanks to Baltimore, and from there to Philadelphia, arriving here August 4th. The tanks were placed under the trees, and the water being at once let out they were re-filled with fresh water from the Schuylkill River. The animals seemed to enjoy the fresh water, swimming about and rolling over and over. Some of the plant Valesneria spiralis gathered from the river was placed in the tanks, and the animals immediately rose to the surface and began to feed, fanning, as it were, the food into their mouths by means of the bristles situated on their upper and lower lips; these bristles spreading out when in use so as to look very much like small fans. The smaller Manatee ate more than the larger one, which was natural, the large one having eaten heartily of grass and ship biscuit before leaving Baltimore in the morning. The tanks were then so arranged that a small stream of fresh water at a temperature of 70° Fahr. could flow constantly through them. Twice during the evening the creatures were visited, and seen to rise at regular intervals to the surface and feed kindly. The following morning, August 5th, the Manatees had eaten all the plant left in the tanks the night before. The creatures from time to time rose to the surface, fanned the grass into their mouth, then sank slowly to the bottom, chewing their food very slowly. August 6th, 7th, 8th, and 9th nothing new had been noticed. On the 10th the large Manatee had eaten, by weight, 21 pounds of Valesneria spiralis in 24 hours. On the 11th a little ceratophyllum was mixed with the valesneria. It was all gone the following day in the tank of the larger Manatee, and had been partially eaten by the smaller one. On the 14th a little sea-weed (Ulva latissima) was put in the tanks; this had all disappeared the next morning. By the 31st the large animal had become quite tame, rising to the surface to have its head scratched when the water was agitated. By September 4th the aquarium, built for the purpose in the carnivora house, and containing water three or four feet deep, was ready for the reception of the Manatees, and the animals were then shifted to it from the tanks in which they had been brought to the garden in the following manner. The water was first entirely drawn off, the tanks were then placed on a truck and water played in to the depth of 18 inches to prevent the animals from bruising themselves in floundering about. The truck with the tanks was then moved to the aquarium, two keepers got into the tank, passed a thick blanket under the Manatee, two keepers in the aquarium seized the blanket, and by a sloping platform from the tank the Manatees were successively slipped up and launched into the aquarium. In the course of a week the Manatees had become much tamer, not floundering as they formerly did when the water was let out of the aquarium, but allowing the keeper to sweep around them. On Sept. 23d the larger Manatee was very sluggish, lying upon the surface of the water, and it would not sink to the bottom or swim about. When it did move bubbles of air were seen to escape from the anus; the excrement was very hard. The animal seeming constipated, the keepers were directed to make it move about from time to time; whilst in motion there was a constant stream of ascending bubbles of air from the anus. At night-time, however, the animal seemed much better, and the next morning was playing about as usual. On the morning of September 28th the Manatees were apparently quite well, but at 9.30 A. M. the keeper going to clean out the aquarium, noticed that the large Manatee was quite sick, and the small one dead. On opening the animal the pericardial sac was found distended, filled with fluid, serous exudation, and other signs of inflammatory action. The remaining organs were perfectly healthy. The alimentary canal was full of the remains of the food the animal had been eating; but I do not regard this as pathological, since Steller, in speaking of the stomach of the Rhytina, notices that it "was distended with masticated sea-weed." The morning that the small Manatee died the temperature of the water, through unavoidable circumstances, was noticed to have fallen to 63° Fahr., the usual temperature being 70° to 71°. It must be mentioned, however, that on August 25th the water was only 66°, and yet the animals did not seem to be inconvenienced. The change of temperature, however, on that occasion was a gradual one. It seems, therefore, very probable that the sudden change in the temperature of the water caused the illness of both the Manatees. The health of the smallest had never been as good as that of the largest and oldest; the cuticle peeling off; it not feeding well; often troubled with constipation, which was relieved by giving the animal the valesneria from the bottom of the tank, with the mud and pebbles adhering to it, etc. From the way in which it followed the largest one, getting under it as if to suckle, it seemed as if it had been captured too young. Apparently the largest Manatee had recovered from the illness which had killed the smallest, and seemed to be doing well, except in that its eyes were a little inflamed, which symptom was attended to, and it was hoped that it would live, but on the morning of October 15th it was found dead. The post-mortem showed that the heart had been affected in the same manner as the first one, and that the pleura and peritoneum and spinal marrow also exhibited signs of inflammation. Whether the largest Manatee had lived through the first attack on account of its comparatively good condition, and died from a more recent one, I cannot say positively, but the temperature of the water had been kept uniform since the smallest one had died. From the manner in which the Manatees grubbed about the bottom of the tank, nosing about like a pig, the extensibility of the snout being much greater than one would suppose, I am inclined to think that if a marine aquarium was built exactly suited to their habits, they would only be seen when rising to the surface to breathe, evidently liking the muddy better than the clear water. When not in motion the Manatee rested by the tip of his tail upon the floor of the aquarium, his head downward, and with the back much arched. At intervals of about one minute to one and a quarter he rose to breathe, and at that time the valves of the nose might be seen to open and shut again as the animal slowly sunk. One can readily understand, after seeing the lungs inflated, how easy it is for the animal to maintain its almost motionless position at variable depths of the water, the lungs acting very much like the air-bladder of fishes, and looking indeed more like the lungs of Lepidosteus than those of a Mammal. The Manatee will eat freely of cabbage, spinach, kale, baked apples, celery tops, etc. When feeding, the curious fanning motion of the bristles on the lips can be well seen. The Manatee seems to be more like a gentle, harmless, stupid sort of water-pig than anything else, with the senses little developed, that of smell being the best. Inasmuch as the Zoological Garden of Philadelphia has succeeded in keeping Manatees alive for two months and a half, let us hope that the effort will be again made here, and by other institutions of similar character, remembering with the poet—

" Nil actum reputans
Si quid superesset agendum."

DESCRIPTIONS OF NEW FOSSIL SHELLS FROM THE TERTIARY OF CALIFORNIA.

BY ROBERT E. C. STEARNS, UNIVERSITY OF CALIFORNIA.

SCALARIA *Lamarck.*

Subgenus **Opalia**, H. & A. Ad.

Opalia varicostata, Stearns. Plate 27, Figs. 2–5.

Shell elongated-conical, turreted, tapering, solid, imperforate, aperture ovate, peristome continuous, thickened; dingy to clear white; suture well defined; whorls united, exceedingly variable in convexity and altitude; specimens all decollate, or truncated, equally solid, though varying in length from .75 to 2.45 inches, showing four and one-half whorls within the first measurement to five in the latter. Perfect specimens have probably from 8 to 12 whorls, or even more. Longitudinal ribs 9 to 12, varying in number, prominence, and regularity, as well as in obliquity, when compared with the axial line of the shell, and, in some specimens, irregularly thickened and distorted by the intrusion of a varical rib more or less conspicuously. In some individuals the termination of the rib at the suture gives the upper part of the whorls a crenulated appearance, and the suture in all specimens is more or less waved, dependent upon the prominence of the ribs, which terminate anteriorly at and join a transverse rib at about the middle of the basal whorl.

Number of specimens 22, all in good condition, save the erosion of the apex.

This is one of those plastic forms which exhibit great variability, but which when a sufficient number of specimens are compared, show well-marked characteristics.

Had the twenty-two specimens examined as above been collected by several persons, and, therefore, divided into many and smaller parcels, and sent, as quite likely would have been the case, to different authors and museums, and thus too widely separated for comparison, it is highly probable, when the latitude of variation which this form presents is considered, that three or four species would have been made out of the above material, which Mr. Henry Hemphill, the collector, kindly placed in my hands for determination.

This is a large species, and perfect specimens, probably, sometimes measure three inches in length; one extreme specimen is strongly suggestive of *Turritella*, and others resemble the living *Opalia borealis*, Gould, common at different places along the coast. It forms a curious, but complete link between the forms like *S. grönlandica*, and the typical *Opaliæ*.

Locality, about eight miles north of San Diego, California, associated with *Pecten* and *Vola*.

Museum of the Smithsonian Institution.

Opalia anomala, Stearns. Plate 27, Fig. 1.

Shell solid, imperforate, elongated-conical, spire gradually tapering; whorls convex, when perfect probably 11 to 14 in number, nearly smooth, being marked only by incremental, and, occasionally, in some specimens, by an outgrown varix; suture well defined; basal whorl traversed transversely by an inconspicuous rib, varying in prominence, in some specimens barely discernible; the convexity or angularity of the lower part of the basal whorl modified by the presence or absence of the basal rib.

Number of specimens 10. Average length 2 inches.

Longitude of smallest	1.87 inches
" of largest	2.37 "

As the apex whorls in all of the specimens are wanting, a careful estimate would add .25 inch to the foregoing average, making the latter 2.25 inches in perfect shells.

This species is readily recognized by the absence of longitudinal ribs, though one or two specimens indicate faint plications near the apex.

Locality, the same as the preceding species.

Collected by Mr. Henry Hemphill, of Oakland.

Museum of the Smithsonian Institution.

December 7.

The President, Dr. Ruschenberger, in the chair.

Twenty-seven members present.

Quercus heterophylla.—Referring to former remarks on this oak, Mr. Thomas Meehan exhibited some leaves almost entire, and some with lobes like the Bartram oak, which he had recently gathered from a tree of the water oak in Mississippi. There were on the same tree, but beyond reach, leaves resembling in outline those of the willow oak. As indicated by Mr. Burke in regard to the *Quercus heterophylla* of New Jersey, and which the evidence already adduced showed were but *Quercus aquatica*, this last species in its home in Mississippi was readily distinguished by the habit of the tree. It had a tendency to branch low, forming a somewhat spreading head, just as the white oak does, in which there is little distinction between the main stem and the leading branches ultimately, while the *Quercus Phellos* had a more slender twiggy habit, and the distinction between the main trunk and the branches were carried forward to old age.

Sabal Palmetto.—Mr. Meehan remarked that this palm was not confined to sandy land near the coast, but extended along the whole line of the Big Black River in Mississippi, at least two hundred and fifty miles above New Orleans, where it was found in immense quantities in swamps. It was only seen in these places, and often entirely in water, with, in some cases, two or three feet of the trunk out of water. It must also be much hardier than people supposed, as at Grenada, a little below which he had seen the palm growing, the thermometer sometimes falls to 10°.

Swamp trees.—Mr. M. further remarked that some years ago he had called attention to the singular fact, that what we know as swamp trees did not grow in swamps because they preferred these wet places, but, as if nature had so ordained in order to clothe these wastes, the seeds will only sprout in wet places or very moist soil. When such trees find themselves in dryer situations they thrive much better than in the wet places, where only the seeds will grow. This is further illustrated by the *Magnolia grandiflora* in Mississippi. The tree is found as a general thing on low bottoms, or along the line of water-courses favorable to the germination of the seeds. Here the best trees seldom exceed from thirty to fifty feet high. The loose soil of Mississippi is, however, continually changing; and a swamp to-day may be high and dry ground a quarter of a century hence. So the *Magnolia grandiflora* often found itself in quite comfortable quarters, and in such cases grew as tall as the loftiest trees—say from fifty to seventy feet high. This desire to get out of the water if possible, he had before suggested as the cause of those peculiar productions of the roots of cypress known as cypress knees. Whenever the tree found itself in land covered by water these knees were thrown up above the surface, till the water had the appearance of being covered by flocks of huge water birds; but when the trees were on land from which the water is now drained away, the knees did not appear.

The *Florida moss, Tillandsia usneoides.*—In regard to this plant, Mr. Meehan thought little was known of its history or development. Some even supposed it to be a parasite. He had been able to ascertain that the seed germinated when it found itself in the hollow crotch of a tree in which vegetable mould had collected. From this young plant hair-like stolons or runners proceeded with buds at every few inches, which buds in time pushed forth into the gray green leaves and stems popularly known as moss. These branches, as they hung, did not send out the hair-like runners, but if they became detached from the original stock and on another branch would do so. It appeared, however, that propagation from seed was extremely rare—the chief increase being by pieces of the branches blown by storms, or carried by other agencies to other locations. Unless already on tall trees so as to be blown down, it was difficult for the "moss" to travel up the tree. As in the case of the grape-vines on the tall trees of this region, it is carried up as the trees grow. On large old cypress trees, it is probable the whole colony is formed of a few original plants of many years of age. Trees which grow rapidly and had chiefly erect branches, such as willows, on which the "moss" would not hang easily, were chiefly free from it; the horizontal branches of the cypress were very favorable to the attachment, and the somewhat pendulous branchlets of the live oak well calculated for entanglement with the loose flowing masses of the *Tillandsia*, and hence it was usually abundant on these trees. That it was merely an epiphyte and not a parasite was clear from its growing as well on telegraph wires as on trees. For a long distance above New Orleans it might be seen attached to the wires, on which it had evidently been originally blown from the trees. His attention had been called to this fact by Col. Hillyard, one of the officers of the railroad, who, without any great scientific pretensions, was yet an acute observer, and who had noticed the little patches on the wire getting larger by growth from year to year as well as if growing on trees. This fact, of course, shows the plant to be a mere epiphyte in character.

Notes on the Genus Catillus, Brong.—At the request of T. A. Conrad, the following note was read:—

The genus *Catillus* was separated from *Inoceramus*, by Brongniart, but the name had been previously given to a fresh-water group, by Humphrey (*Navicula* Lam.). I have described and figured two species in Vol. II. of the United States Geological Survey of the Territories. I intended that a reference to Brongniart's *Catillus* should accompany my descriptions in the Report, but I find it was omitted, and therefore insert it in the Proceedings. The name *Haploscapha* I propose to substitute for *Catillus*, unless the genus *Volviceramus*, Stol., should include the species. The singular turn of the beak and very unequal valves in *Volviceramus* appear to be the only differences between the two groups, and therefore *Haploscapha* may be retained only as a subgenus. Nothing nearly related to this genus has ever been found either above or below the chalk. If the cartilage was attached to the grooved margin, it must have been external and very large. It no doubt should be included in the family *Aviculidæ*.

On Mineral Localities in North Carolina.—Joseph Willcox said that he desired to place on record some mineral localities which he had visited among the mountains in N. Carolina.

In Cherokee Co. on the roadside about half-way between Murphy and Valleytown, corundum is found well cystallized in kyanite. At the same locality crystals of kyanite, an inch in diameter, occur in quartz. Some of these crystals are almost wholly altered into damourite.

At Hogback Mountain, in Jackson Co., on land of Thomas Johnston, occur the most beautiful specimens of pink corundum, associated with margarite and tourmaline.

In Buncombe Co., on the summit of the ridge between the headwaters of Reems Creek and Bull Creek, large garnets are found in mica slate. In Swannanoa Gap, in the same county, a large outcrop of kyanite occurs, extending several miles in a northeastern course. At several places on this vein corundum is found in the kyanite, sometimes in crystals more than two inches long. One specimen of kyanite found there has corundum attached to it on one side, while the other side is altered into damourite, which still retains the bladed structure of the kyanite.

In Madison Co., on the farm of Mr. Carter, near the Burnsville road, 20 miles from Asheville, a white and pink corundum is found, associated with margarite and chlorite. At this place about 1000 pounds of corundum have been dug up; but it is mixed with spinel so abundantly that it possesses little value for commercial purposes.

In Haywood Co., a vein of white feldspar (probably albite) has recently been dug out, to a depth of a few feet, in the pursuit of mica. This vein, about 5 feet wide, is walled on each side with gneiss rocks, and contains corundum associated with margarite or damourite. Occasionally corundum is found in a matrix of mica in large plates, resembling muscovite. This corundum is blue, and affords beautiful specimens. He did not observe any indication of serpentine rocks in this vicinity.

Crystals of rutile, 5 inches long, in quartz, are found on the farm of Garret Ray, near Burnsville in Yancey Co.

Corundum penetrated with crystals of rutile is found near Bakersville, in Mitchel Co. Crystals of actinolite nearly half an inch broad in talc are found on the farm of Mr. English, near North Loe River in same County.

On the farm of Mr. Alley, in Horse Cove, Jackson Co., decremented crystals of muscovite mica are found; also beryls with highly modified terminations.

On the summit of the South Mountains, 7 miles south of Morganton, in Burke Co., an outcrop of serpentine occurs, where may be found magnetite in chlorite, actinolite, talc, and asbestos. One small specimen of corundum has been found there.

The production of muscovite mica is probably greater in the mountain region of N. Carolina than in any other district in the world; and the supply is chiefly obtained in Mitchel and Yancey Counties.

It is found in veins of feldspar, usually much decomposed, and accompanied sparingly with quartz. The wall rocks of the veins are gneiss and mica slate. The largest specimens of mica are obtained in Wiseman's mine, in Mitchel Co., where one huge mass was found 5 feet long, 3 feet wide, and 2 feet thick. At this mine the rare mineral samarskite occurs.

Occasionally beryls, tourmalines, and garnets, are found in these mica mines.

On the Effect of the Bipedal Position in Man.—Dr. ALLEN made some remarks upon the physical characteristics of man, which result from the assumption of the bipedal position. He contrasted the position of a quadruped standing upon his hind legs, with that of a man in the erect attitude such as that seen in the soldier standing at attention. The most conspicuous of these characteristics were seen in the absence of flexion at the knee-joint, the downward directed nostril, and the sigmoid curve of the suprasacral vertebral column. The flattening of the sternum was a sequence upon the presence of the clavicle, and was of course not dependent upon the erect position. Yet, since a fixed clavicle (at least its mammalian expression) cannot act to advantage in any other than this position, the flattening can be assigned a secondary place in the group of characters.

Dependent upon the erect position—plus the flattening of the sternum—is the deflection of the heart to the left side. Dr. A. spoke at length upon the reasons of this deflection, and claimed for it a result of modification of the fœtal proportions of the heart. The typical mammalian act is the fœtal heart; the heart of the adult being a specialized form. The mechanism of the deflection is complicated. Entering into its consideration are (1) the fact that the right side of the heart is fixed by the cavæ at its right border, thus tending to tilt the right ventricle toward the left. (2) The greater weight of the posterior aspect of the heart which throws the posterior wall downward, and the anterior wall upward. (3) The fixation of the left side of the heart, by the pulmonary veins, directly in the median line, while the flattened sternum compels the apex to lie either to one or the other side of the median line. Dr. A. in conclusion divided the characteristics of man into two groups. The first and most important being those the result of evolving from a quadrupedal type a bipedal specialized form; the second, being those belonging to the disposition of special organs, such as the teeth. Within this category may be placed the rudiments of structure, which are better developed in quadrupeds, and which often constitute the "varieties" of human anatomy.

DECEMBER 14.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

DECEMBER 21.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-five members present.

DECEMBER 28.

The President, Dr. RUSCHENBERGER, in the chair.

Fifty members present.

Wm. Stevenson, Jos. R. Roach, H. C. Humphrey, Geo. Wood, and Beulah M. Rhoads were elected members.

The Committee to which it had been referred recommended the following paper to be published.

STUDIES OF THE AMERICAN FALCONIDÆ.—MONOGRAPH OF THE GENUS MICRASTUR.

BY ROBERT RIDGWAY.

Introduction.

No group of American hawks has presented more numerous difficulties in the way of elucidating and strongly characterizing its species; and so complex are the obstacles presented in this case, that the conclusions of authors, who have made the genus *Micrastur* a subject of special study, are very conflicting. The brevity and otherwise unsatisfactory nature of the original descriptions of the older species is the main difficulty, but the perplexing stages of plumage, which in this genus are very remarkable, and so far as we know entirely peculiar among the *Falconidæ*, add still more to the confusion into which their synonymy has fallen. In the latter we have reference to the fact, perhaps not yet generally known, that two distinct phases of color, a gray and a rufescent, occur in some of the species at all stages of growth, which circumstance has but very recently been taken into consideration in defining the specific characters.

The undertaking of this monograph would have been impossible to the author but for the kind assistance of Mr. Osbert Salvin, the eminent English ornithologist, who transmitted for examination his entire series of specimens, representing every known species of the genus.

NATIONAL MUSEUM, WASHINGTON, D. C., July 30, 1875.

Literature.

The first species of this genus was described by Vieillot in 1817, and since that time numerous other names have been proposed, which are as follows, in chronological order:[1]—

(1) *Sparvius ruficollis*, Vieillot, Nouv. Dict. Hist. Nat. X, 1817, p. 322. (= M. ruficollis, adult, rufous phase.)

(2) *Sparvius gilvicollis*, Vieill., l. c. p. 323. (= M. ruficollis, gray phase, adult ?)

(3) *Sparvius melanoleucus*, Vieill., l. c. p. 327. (= M. melanoleucus, ad.)

[1] The names following in parentheses are those adopted in this work.

(4) *Falco leucauchen*, Temm., Pl. Col. pl. 36, 1823. (= M. ruficollis, rufous phase, *juv.* ?)

(5) *Falco leucomelas*, Licht., Verz. Doubl 1823, p. 62. (= M. melanoleucus.)

(6) *Falco xanthothorax*, Temm., Pl. Col. pl. 92, 1824. (= M. ruficollis, rufous phase, adult.)

(7) *Falco brachypterus*, Temm., l. c. pls. 116 (*juv.*), et 141 (adult). (= M. melanoleucus.)

(8) *Nisus concentricus*, Less., Traité d'Orn. 1831, p. 60. (= M. concentricus ? ? ?)

(9) *Carnifex naso*, Less., L'Echo du Monde Savant, année 9, p. 1081. (= M. melanoleucus.)

(10) *Falco percontator*, Cabot, Boston Journ. IV, 1844, 462. (= M. melanoleucus, adult.)

(11) *Micrastur guerilla*, Cassin, Pr. Ac. Nat. Sci. Phila., 1848, 87. (= M. guerilla, young.)

(12) *Astur mirandollei*, Schleg., Ned. Tijdschr. I, 1863, p. 130. (= M. mirandollii.)

(13) *Micrastur macrorhynchus*, Pelz., Orn. Nov. 1865, p. 11. (= M. mirandollii.)

(14) *Climacocercus zonothorax*, Cabanis, Journ. für Orn., 1865, p. 406. (= M. zonothorax.)

Besides the above, authors generally quote *Sparvius semitorquatus*, Vieillot (Nouv. Dict., x. 1817, p. 322), for *M. melanoleucus*, but we cannot identify it with that species (see p. 484); and Pelzeln quotes a manuscript or museum name of Natterer's, as follows:—

Falco trifasciatus, Natt., Catal. Msc. No. 954. (= M. gilvicollis, Pelz., = M. ruficollis, adult, plumbeous phase.)

The more important special discussions bearing upon the species of this genus are the following:—

Pelzeln, August von.—Reise der Osterreichischen Fregatte Novara, um die erde in den Jahren 1857, 1858, 1859, unter den Befehlen Commodore B. von Wüllerstorf-Urbair, Zoologischer Theil. Erster Band. Vögel. Wein, 1865, pp. 176, quarto, pls. 6.

The genus *Micrastur* is treated at considerable length on pp. 9–12. The following species are recognized on p. 12:—

M. brachypterus (Temm.)
macrorhynchus (Natterer.)
xanthothorax (Temm.)

M. guerilla Cassin.
concentricus (Illig.)
gilvicollis (Vieill.)

Of the above *M. macrorhynchus* = *M. mirandollii*, Schleg. The following references are assigned to the other two species which are noticed in detail:—

M. CONCENTRICUS (p. 8.)

Falco concentricus, Illig. in Mus. Berol.

Nisus concentricus, Less. Tr. 60.—D'Orb., Voy. 88.—Schleg. Mus. P.-B., Astures, 51.

Climacocercus concentricus, Caban. in Erichson's Archiv. I, 1844, 265; in Tschudi, F. P. 18, 98; in Schomb. Guiana, III. 735.—Burm. Th. Bras. II, 86.

Circaëtus (Herpetotheres) concentricus, Kaup, Isis, 1847, 260; in Troschel's Archiv. I, 1850, 37.

Micrastur concentricus, Gray, Gen. 28 (Excl. Syn. Vieill.).—Bonap. Comp. 30 (Excl. Syn. Vieill.); Rev. Zool. 1854, 537.—Strickl. Orn. Syn. I, 1855, 123 (part.)

Hab. Guiana (Mus. Berol.), Cayenne (Mus. Vindob.), Bahia, Para (Mus. Berol.), Marabitanas, Barra do Rio Negro, Para (Natterer), prope Rio de Janeiro (Zelebor), Bolivia (D'Orbigny), Mexico (Bonap.).

M. GILVICOLLIS (p. 10.)

Sparvius gilvicollis, Vieill., N. D. X, 323; Enc. Meth. 1264.

Falco trifasciatus, Natterer, Catal. Msc., No. 954.

Climacocercus concentricus, juv. Caban., in Tschudi, F. P. 99.

Falco concentricus, Pucheran, R. Z. 1850, 91.

Hab. Cayenne (Mus. Vindob.), Brazil, Mattogrosso, S. Gabriel, Borba (Natterer), Peru (Cabanis).

M. MACRORHYNCHUS (p. 11.)

Falco macrorhynchus, Natt. Cat. Msc., No. 920.

Hab. Brazil, Barra do Rio Negro, S. Maria de Brancho, Para (Natt.).

Remarks.—The *M. concentricus* of Pelzeln, l. c. = *M. concentricus*, Ridgw., Pr. Boston Soc., N. H., May, 1873, p. 81.

In this important notice Herr von Pelzeln discusses at length, the points of distinction between his *M. concentricus* (= *M. concentricus*, LESS.???), and *M. gilvicollis* (Vieill.), successfully establishing their distinctness.

SCLATER, P. L., M.A., Ph.D., F.R.S., and SALVIN, OSBERT, M.A., F.L.S. Notes on the species of the genus *Micrastur*. <Proc. Zool. Soc. London, May 27, 1869, 364–369.

The seven species recognized are diagnosed as follows (p. 365):—

A. Majores: subtus albi fere unicolores.
- *a.* major, supra nigricans. — 1. *M. semitorquatus.*
- *b.* minor, supra cinereus. — 2. *M. mirandollii.*

B. Minores: sup. subtus albi, dense transfasciati.
- *a.* dorso rufo, pileo cinereo.
  - *a''.* minor; dorso dilutiore rufo. — 3. *M. ruficollis.*
  - *b''.* major; dorso saturatiore rufo. — 4. *M. zonothorax.*
- *b.* dorso cinereo: pileo concolore.
  - *a''.* ventre imo et crisso albis immaculatis. — 5. *M. gilvicollis.*
  - *b''.* ventre imo et crisso cinereo transfasciatis:
    - *a'''.* dorso dilutiore cinereo. — 6. *M. leucauchen.*
    - *b'''.* dorso saturatiore cinereo. — 7. *M. guerilla.*

The synonyms assigned the several species are as follows:—

1. M. SEMITORQUATUS (p. 365).

Sparvius semitorquatus, Vieill.
Sparvius melanoleucus, Vieill.
Falco brachypterus, Temm.
Falco leucomelas, Licht.
Carnifex naso, Lesson.
Falco percontator, Cabot.

2. MICRASTUR MIRANDOLLI (p. 365).

Astur mirandollii, Schleg.
Micrastur macrorhynchus, Pelz (1865).

3. MICRASTUR RUFICOLLIS (p. 366).

Sparvius ruficollis, Vieill.
Falco xanthothorax, Temm.

4. MICRASTUR ZONOTHORAX (p. 366).

Climacocercus zonothorax, Cabanis (1865).

5. MICRASTUR LEUCAUCHEN (p. 367).

Falco leucauchen, Temm.
Micrastur gilvicollis, (adult) Pelzeln, Orn. Nov. 1865, 10.

6. MICRASTUR GUERILLA (p. 367).

Micrastur guerilla, Cass (1848).
Micrastur concentricus, Scl. P. Z. S. 1856, 285.
Micrastur gilvicollis, SCL. & SALV. Ibis, 1859, 218; SCL. P. Z. S. 1858, 96; 1860, 96. LAWR., Ann. Lyc. N. Y. vii. 317.
Micrastur xanthothorax, SCL. P. Z. S. 1857, 368.

7. MICRASTUR GILVICOLLIS (p. 368).

Sparvius gilvicollis, VIEILL., *Micrastur gilvicollis*, jr. PELZ. Orn. Nov. 1865, 10.
Nisus concentricus, LESSON (1831).

Not agreeing with Herr Pelzeln's conclusions concerning *M. concentricus* (LESS.), and *M. gilvicollis* (VIEILL.), Messrs. Sclater and Salvin give to the former the name *M. gilvicollis* (Vieill.), and to the latter that of *M. leucauchen* (Temm.), a view of the matter in which we cannot concur, for reasons stated under the head of these species, respectively.

RIDGWAY, ROBERT. Revision of the Falconine Genera, Micrastur, Geranospiza and Rupornis, and the Strigine Genus Glaucidium. Based upon specimens in the Museum of the Smithsonian Institution, the Academy of Natural Sciences of Philadelphia, the American Museum, at New York, the Boston Society of Natural History, the Museum of Comparative Zoology at Cambridge, and the Ornithological Cabinet of Mr. Geo. N. Lawrence. <Proc. Bost. Soc. Nat. Hist., May 21, 1873, pp. 73–106.

The relationship of this genus to *Herpetotheres* and the *Falcones* in osteological structure is here first pointed out, as well as a striking analogy to the *Strigidæ* in the facial ruff, downy edge to inner webs of the primaries, and dimorphic plumage of some species.

Five species are recognized by the following diagnoses:—

A.—Inner toe appreciably shorter than the outer.
- *a.* Wing, 9.00 or more.
  1. Black above, with a nuchal collar. Tail longer than the wing. *M. semitorquatus.*
  2. Plumbeous above, without a nuchal collar. Tail shorter than the wing. *M. mirandollei.*
- *b.* Wing less than 8.00.
  3. Throat and adjoining portions ashy in the adult. No nuchal collar. *M. ruficollis.*
  4. Throat and crescent behind the jaw white, sharply defined; a nuchal collar of white spots. *M. leucauchen.*

—Inner toe appreciably longer than the outer.
  5. Wing less than 8.00. Tail shorter than the wing. Lower tail-coverts immaculate white. *M. concentricus.*

The references are as follows (omitting *M. semitorquatus* and *M. mirandollii*, which are not different from those given by Sclater and Salvin):—

3. MICRASTUR RUFICOLLIS. (P. 78.)

Sparvius ruficollis, Vieill. (Rufous phase.)
Micrastur gilvicollis, Pelz. Orn., Nov. 1865, 10. (Grayish phase.)
Falco xanthothorax, Temm. (Rufous phase.)

Falco trifasciatus, Natterer. (fide Pelzeln.)
Climacocercus concentricus, juv. Cabanis, in Tschudi Fauna Peruana, 99.
Micrastur guerilla, Cass.
Climacocercus zonothorax, Cabanis.
Micrastur leucauchen, Scl. and Salv., P. Z. S., 1869, 367.

4. MICRASTUR LEUCAUCHEN. (P. 80.)

Falco leucauchen, Temm.

5. MICRASTUR CONCENTRICUS. (P. 81.)

Falco concentricus, Illig.—*Nisus concentricus*, Lesson.—*Climacocercus concentricus*, Caban. in Tschudi Fauna Peruana, 18 and 98.—*Micrastur concentricus*, Pelz. Orn., Nov. 1865, 9.
Falco senex, Natterer in Mus. Vindob. (fide Pelzeln.)
Micrastur gilvicollis, Scl. & Salv., P. Z. S., 1869, 368.

SHARPE, R. BOWDLER.—Catalogue of the Accipitres, or the Diurnal Birds of Prey in the collection of the British Museum. London, June, 1874, 8vo. pp. i.–xiii., 1–479, pls. xiv. Genus "17 Micrastur," pp. 74–80. The following "Key to the Species" is given.

a. Larger: underneath entirely uniform, not barred.
  a'. With a white or creamy buff collar round hind neck. *semitorquatus*, p. 75.
  b'. With no collar. *mirandollei*, p. 76.
b. Smaller: underneath barred in a most regular manner.
  c'. Flanks white, barred with grayish-black.
    c''. Above uniform slate color, brown, or blackish-gray.
      c'''. Foreneck more or less tinged with orange-rufous. *ruficollis*, ♂, p. 76.
      d'''. Foreneck barred with white and black.
        c''''. Lower abdomen and vent white. *gilvicollis*, ♂ ♀, p. 78.
        d''''. Lower abdomen and vent distinctly barred like the rest of under surface. *guerilla*, ♂, p. 79.
    d''. Back rufous or rufous-brown; head ashy-gray or grayish-black, in evident contrast.
      e'''. Chest orange-rufous. *ruficollis*, ♀, p. 76.
      f'''. Chest white, barred with grayish-black.
        e''''. Head and sides of neck ash-gray. *guerilla*, ♀, p. 79.
        f''''. Head and sides of neck grayish-black, the latter slightly washed with rufous. *zonothorax*, ♀, p. 79.
  d'. Flanks uniform bright chestnut. *castanilius*,[1] p. 80.

[1] According to Mr. Salvin (in *Epist.*, May 6, 1875), this bird "turns out to be an African species belonging to the genus *Accipiter* seu *Nisus*. The South American locality given by Verreaux is quite wrong. It is almost identical with *Astur tibialis*, differing only in size."

The chief synonyms and references are as follows:—

3. MICRASTUR RUFICOLLIS. (P. 76.)

Sparvius ruficollis, Vieill.
Falco leucauchen, Temm.
Micrastur leucauchen, Scl. & Salv.
Falco xanthothorax, Temm.
Micrastur gilvicollis (ad.), Pelzeln.

4. MICRASTUR GILVICOLLIS. (P. 78.)

Sparvius gilvicollis, Vieill.
Nisus concentricus, Less.
Micrastur concentricus, Pelz. Orn. Bras.
Micrastur gilvicollis, Pelz. Orn., Nov. Scl. & Salv.

5. MICRASTUR GUERILLA. (P. 79.)

6. MICRASTUR ZONOTHORAX. (P. 79.)

Concordance of Names applied to the several Species of Micrastur by Different Authors.

1875. (Ridgway.)	1874. (Sharpe.)	1873. (Ridgway.)	1869. (Scl. & Salvin.)	1865. (Pelzeln.
1. Melanoleucus (482)	Semitorquatus (76)	Semitorquatus (75)	Semitorquatus (365)	Brachypterus (12).
2. Mirandollii (485)	Mirandollei (76)	Mirandollei (77)	Mirandolii (365)	Macrorhynchus (11).
3. Guerilla (486)	Guerilla (79)	Ruficollis (part)	Guerilla (367)	Guerilla (12).
4. Zonothorax (489)	Zonothorax (79)	Ruficollis (part)	Zonothorax (366)	
5. Ruficollis (490)	Ruficollis (76)	{ Ruficollis (78) { Leucauchen (80)	{ Ruficollis (366) { Leucauchen (367)	{ Xanthothorax (12). { Gilvicollis (part) (10).
6. Pelzelni (494)	....	....	Gilvicollis (part)	
7. Concentricus (496)	Gilvicollis (78)	Concentricus (81)	Gilvicollis (363)	Concentricus (8).

Monograph.

Genus MICRASTUR, Gray.

Brachypterus, Less., Compl. Buff. VII, 1836, 113 (not of Kugel, 1794). Type *M. melanoleucus*.

Carnifex, Less., Rev. Zool., 1842, 378 (not of Sundevall, 1836). Type *C. naso*, Less., = *M. melanoleucus*.

Micrastur, Gray, List Gen. B., 1841, 6; Gen. I, 1844, p. 28, pl. 10, fig. 1. Type *Falco brachypterus*, Temm. = *M. melanoleucus*.

Climacocercus, Cabanis, in Tschudi's Fauna Peruana, Vög. 1845, 98. Type *Sparvius gilvicollis*, Vieill.

Climacourus, Bonap., 1849 (fide Gray).

Rhyncomegus, Bonap., Rev. et Mag. de Zool., 1854, 537. Type *Falco brachypterus*, Temm.

Notihierax, Sund. Disp. Acc. Hemeroharp, 1872, 25. Type *Falco xanthothorax*, Temm.

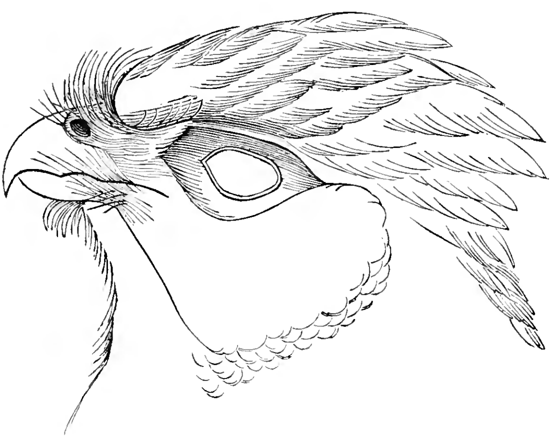
Gen. Ch.—Form of *Nisus*, *i. e.*, wings short, rounded, and concave beneath, tail very long, tarsi and middle toe long and slender, head small, bill short and compressed, with the upper tomium more or less festooned. A distinct ruff around the face, as in *Circus;* inner webs of the primaries with their edges soft and

Fig. 1.

M. melanoleucus. Nat. size.

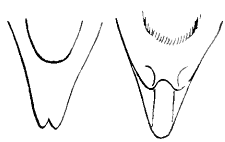
woolly, as in the *Strigidæ.* Bill short, high, and much compressed, nearly twice as deep as broad at the base; the culmen

Fig. 2.



M. ruficollis. Nat. size.

Fig. 3.



abruptly curved; gongs greatly convex; lower mandible truncated, the terminal outline rounded when viewed laterally, but in front divided by an angular notch (Fig. 3); upper tomium with a more or less prominent festoon. Cere almost covered by fine hair-like bristles, which are strongly recurved on the top. Nostril broadly oval, or nearly circular, against the anterior edge of the cere. Orbital region and superciliary shield perfectly bare, the

Fig. 4.

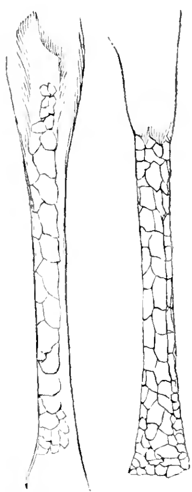
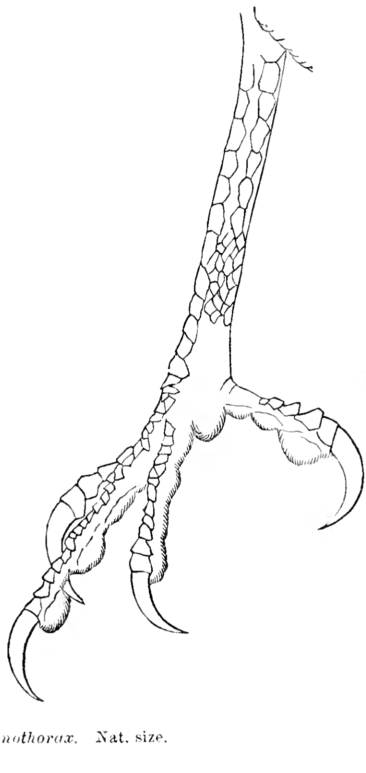


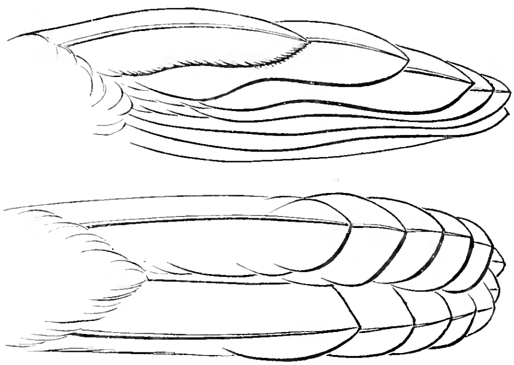
Fig. 5.



M. zonothorax. Nat. size.

latter very prominent and exposed for its whole length, as in *Falco*. Tarsus more than twice as long as the middle toe, scarcely feathered below the knee; its scutellæ of a hexagonal form, and arranged in longitudinal series—larger in front and behind, where they sometimes form a continuous frontal and posterior series of rather quadrate plates. (Figs. 4, 5.) Top of the toes with irregular, sometimes interrupted, transverse scutellæ to the base. Web between outer and middle toes well developed. Claws of normal form, well curved, and exceedingly sharp. Wing short, much rounded, and very concave beneath, the primaries much bowed (as in *Nisus*); third to sixth quill longest; first shortest; outer

Fig. 6.

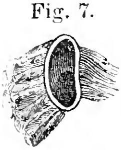


M. ruficollis. ½ nat. size.

five or six with their inner webs slightly sinuated. Tail very long (nearly equal to or exceeding the wing), much rounded, or graduated. Feathers of the crown and occiput well developed, sometimes[1] large and broad, capable of being erected into a broad, depressed crest.

This well-characterized and very remarkable genus comes nearest *Herpetotheres*, with which it agrees closely in osteological structure as well as in essential features of external form; but it differs in many important points throughout its whole anatomy—more especially in the development of the nasal bones, which are much less completely ossified—almost as little so as in the *Buteoninæ*. It presents analogies with *Circus* and the *Strigidæ* in the facial ruff, and with the latter in the character of the inner webs of the primaries, as well as in the dimorphic plumage of some of the species, and with *Nisus* in general aspect and mode of life. The remarkable

Fig. 7.



M. ruficollis.

[1] Notably in the smaller species. (See Fig. 2.)

analogy to the Owls is seen not only in the respects pointed out, but also in the enlarged ear-aperture, of oval form and vertical position (see Fig. 7), and the dense hair-like antrorse bristles which cover and nearly conceal the cere.

We have elsewhere demonstrated that this genus belongs to the subfamily *Falconinæ*,[1] by reason of osteological affinites, notwithstanding its exceedingly different appearance externally.

From the examination of nearly one hundred and fifty specimens of the genus, we have been able to make the following deductions regarding the nature of the changes to which the plumage of these hawks is subject: (1) There is no appreciable sexual difference, either in the young or adult stages; (2) there are two well-marked growth stages, causing the young birds to differ very essentially in plumage from the adult; and (3) certain species are more or less subject to erythrism, individuals being deeply rufescent and others clear plumbeous, *these phases being entirely independent of age, sex, or season*, and connected by specimens variously intermediate between the two extremes. This dimorphism of plumage is in every respect analogous to that so well known to characterize certain owls, as the *Syrnium aluco* of Europe, the common *Scops asio* of the United States, and several species of *Glaucidium*, in Tropical America. In the case of the *Glaucidium ferrugineum*, the rufous phase is far commoner in the Amazonian region than in Middle America, it being the rule throughout the former district and the exception in the latter; in the same way, *Micrastur ruficollis*, of Brazil, etc., is rufous in perhaps seventy-five per cent. of the individuals composing that species, and the development of the erythrism is extreme; but in *M. guerilla*, the northern form, it occurs in perhaps less than fifty per cent., and then consists of only an appreciable tendency toward this condition, seen in a rusty wash overlying the plumbeous of the back, producing thereby a warm-sepia tint.

All the known species agree in the following—

Common Characters.—Tail dusky tipped and irregularly barred with white. (A[2]) Adult: Above plain blackish or plumbeous,

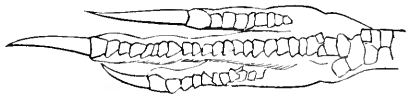
[1] Outlines of the Natural Arrangement of the Falconidæ. [Read before the Philosophical Society of Washington, April, 1873.] <Bull. U. S. Geological and Geographical Survey of the Territories, No. 4, second series. Washington: Government Printing Office, June 10, 1875.

[2] These letters and figures in parentheses refer to those of the following table.

beneath immaculate white or ochraceous. Young: (1) Beneath spotted or barred with dusky, or (2) with the feathers bordered with grayish. (B) Adult: Above varying from plumbeous to rufous; beneath marked with regular, ray-like bars of dusky and white except on the throat and sometimes (in *M. concentricus*) the crissum and anal region. Young: Throat and half-crescent behind the ear coverts, white; lower parts white, with or without coarse bars of dusky.

They may be distinguished by the following differential characters:—

Fig. 8.



M. pelzelni. Nat. size.

A.—Outer toe decidedly longer than the inner. (Fig. 8.)

a. Size large (wing more than 8.00).

1. Tail longer than the wing (wing 9.70–11.70, tail 9.60–13.00). Above black with a nuchal collar of white or ochraceous. Entire Intertropical Region, except Andean district. *M. melanoleucus.*
2. Tail shorter than the wing (wing 8.80–9.30, tail 7.80–9.00). Above plumbeous, without a nuchal collar. Costa Rica to Brazil. *M. mirandolii.*

b. Size small (wing less than 8.00).

3. Wing, 6.50–7.10; tail, 6.90–7.50; tarsus, 2.20–2.50; middle toe, 1.10–1.25. Tail crossed by 3–6 white bars.[1] Adult: Tail crossed by 3–4 bars of white. Above uniform plumbeous or chocolate, the head and neck plumbeous. Throat light-gray; jugulum, breast, and entire lower parts barred with white and dusky. Young: Above dark clove-brown, sometimes indistinctly barred or spotted with rusty. Beneath white or buff, with coarse bars of dusky (rarely immaculate). Middle America, south to Ecuador. *M. guerilla.*
4. Wing, 6.90–7.50; tail, 7.60–8.40; tarsus, 2.20–2.45; middle toe, 1.15–1.25. Adult (*rufous phase*): Above rusty-chocolate, becoming grayish-brown on the crown; throat light chocolate; jugulum, and entire other lower parts transversely barred with dusky and white. Tail crossed by 4–5 bars of white. Young: Above dark sooty brown, indistinctly barred with light rusty; crown and nape sooty black. Tail crossed with 6–7 bars of white. Lower parts buffy white, or buff, without rufous tinge on breast. Venezuela and Columbia. *Z. zonothorax.*

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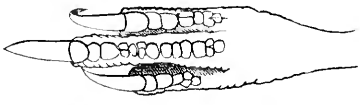
[1] The terminal bar is not counted in these diagnoses.

5. Wing, 6.60–7.10; tail, 7.30–7.80; tarsus, 2.30–2.45; middle toe, 1.15–1.30. Adult (*plumbeous phase*): Above light plumbeous, the wings browner. Tail crossed by four bars of white; throat light gray; jugulum more or less washed with light rufous; entire lower parts barred with white and plumbeous. *Rufous phase:* Above rusty brown, becoming more plumbeous on the crown; neck and entire jugulum light rufous. Tail crossed by 4–5 bars of white. Young (*plumbeous phase*): Above grayish-brown or umber; tail crossed by 6–8 bars of white spots; throat white, with a half-crescent branch behind the ear-coverts; breast scarcely tinged with rufous. *Rufous phase:* Above dark rufous or rusty chocolate, the crown darker and more slaty. Tail crossed by 6–7 interrupted bars of white; throat and half crescent behind ear-coverts, white; breast more or less strongly washed with rufous. Eastern South America, south to a little beyond latitude 10° South (Sharpe); Venezuela and Guiana (SHARPE). *M. ruficollis.*

6. Wing, 6.50; tail, 6.30; culmen, .60; tarsus, 2.30; middle toe, 1.20. Adult (*plumbeous phase*): Tail crossed by two bars of whitish or pale brownish-gray. Above uniform dark plumbeous, the tail darker and the wings browner. Throat light-gray; rest of lower parts white, marked *everywhere* with very narrow bars of dark plumbeous, these bars very narrow and distinct on the flanks and crissum. Peruvian Amazons. *M. pelzelni.*

B.—Outer toe not longer than the inner. (Fig. 9.)

Fig. 9.



M. concentricus. Nat. size.

f. Tail shorter than the wing. Wing, 7.10–7.75; tail, 6.30–7.00; culmen, .60; tarsus, 2.25–2.45; middle toe, 1.00–1.08. Adult: Tail crossed by 1–1 narrow bars, or lines, of white. Above dull plumbeous, the tail darker and the wings browner. Throat grayish-white; other lower parts white, the *crissum, anal region*, and lining of the wing, *and sometimes the flanks and tibiæ, immaculate;* the other portions barred with plumbeous. Tropical South America. *M. concentricus.*

1. MICRASTUR MELANOLEUCUS.

Sparvius melanoleucus, Vieill., Nouv. Dict. Hist. Nat., x, 1817, 327; Enc. Méth., 1267. [Adult.]

Micrastur semitorquatus, Scl. and Salv., Ibis, 1839, 218; Pr. Zool. Soc. Lond., 1869, 365; Nom. Av. Neotr., 1873, 120.—Strickl., Orn. Syn., 1, 1855, 122.—Lawr., Ann. N. Y. Lyc., VII, 1862, 8; IX, 1868, 134; Mem. Boston Soc., N. H., II, 1874, 299.—Salvin, P. Z. S., 1870.—

Ridgw., Pr. Boston Soc., May, 1873, 76.—Sharpe, Cat. Ac. B. M., 1874, 75.

Climacocercus semitorquatus, Caban. J. f. Orn., 1865, 407.

Falco brachypterus, Temm., Pl. Col., I, 1824, pls. 116 (juv.), et 141 (adult).

Astur brachypterus, Spix, Av. Bras., I, 1824, 9.—Vig. Zool. Journ., I, 338.—Steph. Zool., XIII, pt. 2, 28.

Nisus brachypterus, Less., Man. Orn., I, 1828, 98 ; Tr. Orn., 62.—Cav., Règ. An., ed. 2, I, 334.—Schleg., Mus. Pays-Bas, Astures, 1862, 52.

Accipiter brachypterus, Gray, List B. Brit. Mus., 69.

Micrastur brachypterus, Gray, Gen. B., ed. 2, 1841, 6; fol. 1849, 28, sp. 1, pl. 10, f. 1 ; Hand List, I, 31, No. 290.—Bonap. Consp., I, 1850, 30.—Pelz. Reis., Nov. Vög., 1865, 12 ; Orn. Bras., 1871, 7, 398.

Herpetotheres brachypterus, Kaup, Contr. Orn., 1850, 71.

Rhynchomegas brachypterus, Bonap., Rev. et Mag. Zool., 1854, 537.

"*Falco leucomelas*, Illig.," Licht., Verz. Doubl., 1823, 62.

Carnifex naso, Less., L'Echo du Monde savant, année 9, 1081 ; Rev. Zool., 1842, 379.

Falco percontator, Cabot, Journ. Bost. Soc., N. H., IV, 1844, 462.

Nigriblanco, Azara, Apunt, I, 1802, 124.

Hab. The entire Intertropical Region (except Andean district), north to Mazatlan (Pacific coast) and Vera Cruz (Atlantic coast), and south to Paraguay. *Not yet recorded from the Andean district south of New Granada, nor from western Amazonia.*

Sp. Char. Wing, 9.70–11.70 ; tail, 9.60–13.00 ; culmen, .80–1.00 ; tarsus, 3.10–3.65 ; middle toe, 1.60–2.05. Third to sixth quill longest ; first much the shortest. Above plumbeous-black or blackish-brown, interrupted by a more or less conspicuous nuchal collar of white or ochraceous. Tail crossed by 4–7 narrow light bands, usually interrupted. The last one terminal and the first concealed. Adult : Lower parts entirely immaculate, the color varying from pure white to deep ochraceous-buff ; upper parts unvariegated ; nuchal collar distinct. Young : Lower parts more or less spotted or barred with blackish ; upper parts usually more or less variegated with indistinct bars or transverse spots of ochraceous or dull rusty ; nuchal collar more interrupted. "Iris brown."

Remarks.—It is a noteworthy fact that all the specimens from Costa Rica in the series we have examined are deep ochraceous beneath, while those from Mazatlan and Colima are pure white. Whether this difference results from climatic causes, or merely different stages of growth of the feathers, it is difficult to decide ;

but the latter conjecture is rather favored by the circumstance that of four specimens from Tehauntepec (an intermediate locality by the way), three obtained in August, and just freshly moulted, are ochraceous beneath, while one shot in February, with older plumage, is white.

Notwithstanding that this species has been so generally identified with the *Sparvius semitorquatus* of Vieillot (Nouv. Dict. Hist. Nat., x. 1817, 327, et Enc. Méth., 1263), we cannot concur in this opinion, the very first clause in the diagnosis of that bird precluding the possibility of it being this species. The diagnosis is as follows:—

"*L'Epevier a demi-collier roux.* 6. S. Semi-torquatus. *S. vertice albo, nigricante transversim striato;* semi-torque rufescente, fusco terminato; corpore suprà nigricante, rufescente striate; ventre albo; rostro fusco; pedibus flavescentibus."

It being well known that the present species always, in every stage of plumage, has the crown uniform black, we do not see how the description of a bird with the "crown white, transversely barred with black," can possibly be made to apply to it.

List of Specimens in U. S. National Museum.

Catalogue number.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Nature of specimen.
16577	....	....	Panama R.R.	....	J. McLeannan...	S. (Skin.)
29301	129	♀	Colima, Mex.	February ..	J. Xantus.......	S.
30237	526	♂	Sierra Madre, Mex.	April, 1863 .	" "	S.
30238	527	♀	" " "	" " ..	" "	S.
33207	....	....	Costa Rica (San José).......	....	J. Carmiol.......	S.
33552	115	♀	Mirador, Mex.	October	C. Sartorius	S.
37337	352	♂	Mazatlan, Mex.	....	A. J. Grayson ...	S.
47365	....	....	Costa Rica (Angostura)	....	J. Carmiol.......	S.
51300	293	♂	" " (Rancho Rodondo)	Nov. 16, 1867	A. von Frantzius.	S.
51301	292	—juv.	" "	....	" " "	M. (Mounted)
51344	....	♂	Mazatlan, Mex.	March, 1868	A. J. Grayson ...	S
52815	353	—ad.	" "	....	" " ...	M.
52824	354	♂	" "	....	" " ...	S.
59511	1001	....	Tehuantepec, Mex.	November ..	F. Sumichrast....	S.
59512	1002	....	" "	"	" "	S.
64930	603	—ad.	Costa Rica.	....	W. M. Gabb	S.
64931	287	— "	" "	....	" "	S.
66330	19	♂juv.	" " Lipurio	....	" "	S.
66331	21	♂ "	" " "	....	" "	S.
67279	6a	♂ ad.	Tehuantepec, Mex.	Feb. 19, 1872	F Sumichrast ..	S.
67858	251	♂ "	Costa Rica (Talamanca).....	 1874	W. M. Gabb	S.

Other specimens examined.—Mus. Acad. N. S. Philad., 7; Boston Soc., 2; G. N. Lawrence, 3; Sumichrast collection, 5. Total, 38.

2. MICRASTUR MIRANDOLLII.

Astur Mirandollei, Schleg., Mus. Pays-Bas, Astures, 1862, 27; Ned. Tijdschr. I. 1863, 130.
Micrastur Mirandollei, Scl. and Salv., Proc. Zool. Soc. Lond. 1867, 759; Ib. 1869, 395; Nom. Av. Neotr. 1873, 120.—Gray, Hand List, I, 31, No. 391.—Pelz., Orn. Bras. IV, 398.—Ridgw., Pr. Boston Soc. N. H., May, 1873, 77.—Sharpe, Cat. Acc. B. M. 1874, 76.
"*Micrastur macrorhynchus* Natt." Pelz., Orn. Novara, 1865, 11; Orn. Bras., 1871, 7.

Hab. Intertropical Region, north to Costa Rica (Nat. Museum), south to Amazonia.

Sp. Char. Wing, 8.80–9.30; tail, 7.80–9.00; culmen, .80–.85; tarsus, 2.80–3.15; middle toe, 1.30–1.50. Fifth quill longest; first shortest.

Adult: Above continuous, uniform plumbeous; tail blackish, narrowly tipped with white, and crossed by three narrow bands of white, each inclosing a dusky mottling—or of uniform pale grayish-brown. Lower parts, including the lining of the wing and sometimes the maxillæ, continuous white, usually with the shafts of some of the feathers black; the breast sometimes with transverse crescentic spots of pale grayish.

Young (67,862, Nat. Mus., Costa Rica; Prof. Wm. M. Gabb): Similar to the adult, but above dark-slate, with a slight sepia cast, below creamy-white, all the feathers bordered with dull brownish-gray and with shaft-streaks of darker, these markings heavy on the jugulum and breast, narrower and fainter posteriorly. Tail as in the adult. Bill bright-yellow, the base of the culmen horn-color; cere and orbits duller yellow; tarsi and toes bright yellow; claws deep black, "iris olive." Wing, 8.80; tail, 8.70; culmen, .80; tarsus, 3.10; middle toe, 1.50. Fifth quill longest; first much shortest; outer six appreciably sinuated. Graduation of the tail, 1.40.

List of Specimens in U. S. National Museum.

Catalogue number.	Original No.	Sex and age.	Locality	From whom received.	Nature of specimen.
67862	352	♂ juv.	Talamanca, C. R.	Prof. W. M. Gabb	S.

Other specimens examined.—Mus. Acad. N. S. Philad., 2; Boston Soc., 1; G. N. Lawrence, 2; Total, 6.

3. MICRASTUR GUERILLA.

Micrastur guerilla, Cassin, Pr. Acad. Nat. Sci. Phila. 1848, 87 (Young); Journ. Phil. Ac. I, 1850, pl. xl.—Gray, Gen. B. I, 1849, 28; Hand List, I, 1869, 31.—Bonap. Consp. I, 1850, 30.—Strickl. Orn. Syn. I, 1855, 123.—Scl. and Salv. P. Z. S. 1869, 368; 1870, 214-838; Nom. Av. Neotr. 1873, 120.—Salvin, P. Z. S. 1870, 214-16.—Sharpe, Cat. Diurn. Acc. Br. Mus. 1874, 79.

"*Micrastur concentricus*," Scl. P. Z. S. 1856, 285.

"*Micrastur gilvicollis*," Scl. P. Z. S. 1858, 96.—Scl. and Salv. Ibis 1859, 218. Lawr., Ann. N. Y. Lyc. VII, 1861, 317.

"*Micrastur xanthothorax*," Scl. P. Z. S. 1859, 368.

"*Micrastur ruficollis*," Ridgw. Pr. Boston Soc. N. H., May, 1873, 78. (In part.)

Hab. Middle America, from Vera Cruz, Eastern Mexico, to Ecuador (Guayaquil).

Sp. Char. Wing, 6.50–7.10; tail, 6.90–7.50; culmen, .55–.70; tarsus, 2.20–2.50; middle toe, 1.10–1.25.

Adult. *Plumbeous phase:* Above uniform plumbeous, the wings slightly browner, and the tail blackish. Tail narrowly tipped with white and crossed by 3–4 narrow oblique bars of white or dull brownish-gray (broader, and always white, on the inner webs). Cheeks and throat ash-gray, the latter becoming lighter centrally. Other lower parts white, barred *everywhere*, in very regular transverse rays, with dark-plumbeous. *Brown phase:* Similar, but entire back and wings chocolate, umber, or sepia-brown, contrasting strongly with the plumbeous of the head and neck; jugulum more or less tinged with brown.

Young. *Spotted phase:* Above dark clove-brown, the crown and nape brownish-black; nape crossed by a collar of white spots, sometimes continuous and conspicuous, often nearly concealed; scapulars and entire wings indistinctly barred, or transversely spotted, with paler, more rusty-brown, these bars being most conspicuous on the tertials. Tail dusky-black, tipped with white, and crossed by 4–5 narrow bars of the same. Throat white, this extending upward behind the dark-brown auriculars in the form of a half crescent; remaining lower parts buffy-white or deep-buff barred (less regularly and finely than in the adult) on the breast and sides with dusky-brown—rarely barred over the whole surface. *Plain phase:* Similar, but the pale-rusty bars on wings and scapulars obsolete, and the colors generally clearer; usually less heavily barred beneath—sometimes immaculate.

Remarks.—In all stages of plumage there is a very considerable range of individual variation, as to both size and markings, though the relative proportion of the parts is very uniform. In two adults, one from Coban, Guatemala, the other from Calovevora, Veragua, the throat is clear bluish-gray, the jugulum similar, rayed with very narrow lines of white. In another specimen from Veragua (a male from Calobre) the colors are darker throughout, the bars on the breast being nearly black; there is a decided brown wash on the jugulum, and the throat is nearly white centrally. A specimen from Vera Paz, Guatemala, and one from San Pedro, Honduras, have the throat pale-gray, slightly tinged with brown posteriorly; the bars on the jugulum white and dull-slate in equal width; while they are alike in all other respects also. The specimen from Nanegal, Ecuador, is very similar to these.

The young birds (= *M. guerilla*, Cass., l. c.) vary individually, so that only the extremes of their plumage need be described. The darkest example is one from the Volcan de Chiriqui (No. 4454, E. Arce). In this specimen the lower parts are deep-buff, marked *everywhere* with regular, sharply-defined broad bars of dark-brown, these bars as distinct and regular as in the adult, but broader, and separated by wider intervals, the ground-color being light buff. The upper parts of this specimen, however, are about of average character. A Vera Paz specimen is very similar, the only difference being that the bars are just appreciably narrower, and the ground perceptibly paler buff. The darkest upper plumage is seen in another Veragua specimen, in which the whole upper surface is a very dark sooty-brown, or blackish-umber, the crown and nape brownish-black; the wings and scapulars show numerous indistinct bars and transverse spots of pale brown. The lower parts are deep buff, tending to ochraceous, but the bars are very distant and confined to the breast and sides. The palest example is one from Guatemala (Choctun, Vera Paz, Jan. 1860), in which the lower parts are buffy-white, entirely *immaculate;* the upper parts are dark grayish-brown, or brownish-dusky, the top of the head darker, the wings and scapulars with the lighter bars and spots nearly obsolete. The latter specimen would probably have assumed the plumbeous phase of the adult dress, and the two others the brown-backed phase. On the right side of this specimen is a perfect feather of the new moult, corresponding with the adult, and the lower feather of the tibial plumes is similar. Another Choctun specimen is almost free from markings below, while the upper parts are absolutely destitute of the lighter spots or bars on the wings or scapulars.

List of Specimens in U. S. National Museum.

Catalogue number.	Original No.	Sex and age.	Locality.	From whom received.	Nature of specimen.
30413	166	......	Costa Rica	Dr. A. von Frantzius	S.
32980	....	♀	Mexico	Verreaux	S.
50599	....	......	Guatemala	Dr. Van Patten	S.
54938	....	......	Guayaquil	Dr. Destruge	M.
58938	....	......	"	" "	S.
64927	604	ad.	Costa Rica	Professor Gabb	S.
64928	381	♀ ad.	" "	" "	S.
64929	522	" "	" "	" "	S.

The following measurements are of specimens in the collection of Mr. Osbert Salvin:—

		Wing.	Tail.	Culmen.	Tarsus.	Middle toe.
ADULTS.						
Vera Paz		6.90	7.50	.70	2.40	1.25
Coban		6.60	7.30	.55	2.30	1.10
Calovevora, Veragua	♂	6.85	7.30	.60	2.40	1.10
Colobre	♂	6.50	....	.60	2.40	1.15
San Pedro, Honduras		7.10	7.50	.65	2.40	1.20
Nenegal, Ecuador		....	....	.60	2.35	1.25
YOUNG.						
Vera Paz	2262	6.65	6.90	.55	2.20	1.10
" "	2259	6.90	7.15	.65	2.50	1.20
" "	4521	7.00	7.10	.62	2.40	1.25
" "	2261	6.50	7.00	....	2.35	1.15
" "	4522	6.85	7.40	.60	2.50	1.15
Veragua		6.50	6.90	.60	2.40	1.10
Volcan de Chiriqui	4454	6.70	6.90	.60	2.30	....
Jalapa, Mex.		6.75	7.40	.60	2.30	1.15

4. MICRASTUR ZONOTHORAX.

Climacocercus zonothorax, Cabanis, Journ. für Orn. 1865, 406.
Micrastur zonothorax, SCL. and SALV., P. Z. S. 1869, 366; Nom. Av. Neotr. 1873, 120.—GRAY, Hand-List B., I, 1869, 31.—SHARPE, Cat. Diurn. Acc. Br. Mus. 1874, 79.

Hab. New Granada and Venezuela.

Sp. Char. Wing 6.90–7.50; tail 7.60–8.40; tarsus 2.20–2.45; middle toe 1.15–1.25.

Adult (*brown phase*): Above rusty-chocolate, becoming gradually less reddish on the head, the crown being dull grayish-brown. Tail black, narrowly tipped with white, and crossed by 3–4 narrow bars of white. Whole throat light chocolate, like the cheeks; remaining lower parts, *including the jugulum*, and lining of the wing finely barred with clear dark slate and white, the white bars broader posteriorly but much narrower than the slaty ones on the jugulum.

Young: Above dark sooty-brown, much tinged with rusty, and indistinctly barred or spotted transversely with lighter rusty over the whole surface. Crown and nape sooty-black, separated from the dusky-brown of the back by a more or less distinct nuchal collar of white or buff. Tail black, narrowly tipped with white, and crossed with 5–6 narrow bands of white. Lower parts buffy-white or deep buff, sometimes immaculate, but generally more or less barred with brownish-dusky; the throat white, sending up a branch behind the brown ear-coverts, in form of half a crescent.

Remarks.—This form appears to be distinct from both *M. guerilla* and *M. ruficollis*, between which it is somewhat intermediate, though larger than either; but the differences are much harder to define than they are to perceive. The series before us is very small, while only one specimen is an adult; to make the material still more unsatisfactory, two of the three young birds are not full-grown, so that measurements would be useless.

The *M. zonothorax* is considerably larger than either of its allies, the tail especially being longer; the old bird resembles most that of *M. ruficollis*, but the jugulum is barred slate and white, like the breast, instead of being covered by a rufous patch; the head, too, is browner. The young bird is in colors more like that of *M. guerilla*, lacking entirely any rufous wash on the breast, and having the upper parts distinctly spotted with light rusty on a blackish ground; but the bars on the tail number from 5 to 6, instead of 2 to 4.

The following measurements are from specimens in the collection of Mr. Osbert Salvin:—

		Wing.	Tail.	Culmen.	Tarsus.	Middle toe.
ADULT.						
Venezuela		6.90	7.60	.62	2.30	1.20
YOUNG.						
Porto Cabello	♀	7.50	8.40	.70	2.45	1.25
Venezuela		7.20	....	....	....	....
Bogota	♂	7.20	8.25	....	2.20	1.15

5. MICRASTUR RUFICOLLIS.

[*Rufous phase.*]

Sparvius ruficollis, Vieill., Nouv. Dict. X, 1817, 322 (*adult!*); Enc. Méth. III, 1263.—Pucheran, Rev. Zool. 1850, 91.

Micrastur ruficollis, Strickl., Orn. Syn. I, 1855, 122.—Scl. and Salv., P. Z. S. 1869, 366; Nom. Neotrop. 1863, 120.—Gray, Hand List, I, 1869, 366.—Ridgw., Pr. Boston Soc. N. H. XVI, May, 1873, 78 (part).—Sharpe, Cat. Acc. Br. Mus. 1874, 76 (part).

Falco xanthothorax, Temm., Pl. Col. I, 92, 1824 (*adult*).—Spix, Av. Bras. I. 1824, 19.

Nisus xanthothorax, Less., Man. Orn. I, 96; Tr. Orn. 58.—Cuv., Règ. An. ed. 2, 334.

Accipiter xanthothorax, Gray, List B, Brit. Mus. 69.—Cassin, Proc. Ac. Nat. Sc. Phila. 1848, 88.

Climacocercus xanthothorax, Burm., Syst. Ueb. II, 1856, p. 122.

Micrastur xanthothorax, Gray, Gen. B. fol. sp. 2.—Bonap., Consp. I, 1850, 30.—Pelz., Orn. Nov. 1865, 12; Orn. Bras. I, 1868, 399.

Herpetotheres xanthothorax, Kaup, in Contr. Orn. 1850, 71.

? *Falco leucauchen*, Temm., Pl. Col. 1823, pl. 36 (*young?*)—Pucheran, Rev. Zool. 1852, 91.

Astur leucauchen, Less., Man. Orn. I, 92.—Cuv., Règ. An. ed. 2, 332.

Nisus leucauchen, Less., Tr. Orn. 60; Rev. Zool. 1850, 91 (fide Pelzeln).

[*Plumbeous phase.*]

? *Sparvius gilvicollis*, Vieill., Nouv. Dict. N. H. X, 1817, 323 (*adult*); Enc. Méth. III, 1264.—Pucheran, Rev. Zool. 1850, 91.

Micrastur gilvicollis, Pelz., Orn. Bras. 399; Orn. Nov. 1865, 10.

Micrastur leucauchen, Bonap., Consp. I, 1850, 30.—Strickl., Orn. Syn. I, 1855, 123; Scl. and Salvin, P. Z. S. 1869, 367 (*excl. syn.*), [*adult!*]—Ridgway, Pr. Boston Soc. Nat. Hist. XVI, May, 1873, 80 [*young*].

Accipiter leucauchen, Gray, List B, Brit. Mus. 68.—Cassin, Pr. Ac. Nat. Sci. Philada. 1848, 88.

? *Falco trifasciatus*, Natterer, Cat. Msc. No. 954 (*fide* Pelzeln).

Falco concentricus, Pucheran.

Micrastur ruficollis, Sharpe, Cat. Acc. Br. Mus. 1874, 76 (part).

Hab. Eastern South America.

Sp. Char. Wing, 6.60–7.10; tail, 7.30–7.80; tarsus, 2.30–2.45; middle toe, 1.15–1.30.

Adult. *Plumbeous phase:* Above light plumbeous, or bluish ash-gray, the wings browner; tail slate-black, narrowly tipped with white, and crossed by three narrow bars of white. Throat and jugulum very light grayish, the former nearly white centrally, and the latter more or less washed with light rufous. Other lower parts white, everywhere finely barred with narrow and very regular rays of plumbeous. Bill black, the basal half of the lower mandible light yellowish. *Rufous phase:* Above rusty-brown, inclining to rufous; crown ash-gray or plumbeous, usually in abrupt contrast; neck and entire jugulum light rufous; other lower parts everywhere transversely barred with dusky plumbeous and white. Tail blackish-dusky, narrowly tipped with white, and crossed by 3–4 narrow bars of white, these sometimes obsolete on outer webs.

Young. *Plumbeous phase* (= *M. leucauchen*, Ridgway, *l. c.*): Above varying from grayish-brown to umber, interrupted by a more or less conspicuous nuchal collar of whitish spots; tail blackish-dusky, narrowly tipped with white, and crossed by 5–7 rows of interrupted transverse spots of the same. Throat white, sending up a conspicuous branch, in the form of a half crescent, behind the brownish ear-coverts. Beneath white, more or less tinged with buff; the breast sometimes washed with light rufous, the whole surface (except throat and anal region) narrowly barred with blackish, the bars growing fainter on the breast. *Rufous phase* (= *Falco leucauchen*, Temminck?): Above varying from dark rufous to dusky chocolate; crown darker and more slaty.

Tail dusky, narrowly tipped with white, and crossed by 5–6 narrow, interrupted bars of the same. Throat and half crescent behind the ear-coverts, whitish; breast more or less washed with rufous; other lower parts white or buff, transversely barred with dusky.

Remarks.—In this species there is a gradual transition in certain specimens between the two extremes described as the plumbeous and rufous "phases."

a. *Plumbeous phase:* A specimen from Bahia has the entire dorsal surface clear, light bluish-plumbeous, the remiges inclining more to brownish-gray. The jugulum has only a faint wash of very light rufous. Another specimen from the same locality has each feather of the dorsal region bordered terminally with dull rusty, while the entire wings are strongly washed with this color; the jugulum is more extensively washed with a deeper shade of rufous. The young birds examined agree quite closely with the terms of the above diagnosis, the series exhibiting little individual variation, shown chiefly in the amount of rufous tinge on the breast, which is sometimes extensive, and again entirely absent.

b. *Rufous phase:* Two specimens from Brazil (Rio Janeiro and Bahia) have the entire dorsal region uniform dull rufous, abruptly contrasted against the dull plumbeous of the nape and crown. Another has the plumbeous of the crown and nape extended back on the interscapulars (even tinging some of the scapulars) which are merely bordered with rusty; the effect being a gradual blending or admixture on the back, of the plumbeous and rufous.

The bars beneath in these three specimens vary from plumbeous-gray to brownish-black, the white bars being on different specimen of different relative width to the dark bars. The specimen from Rio Janeiro has the tail-bars obsolete on the outer webs, which are uniform brownish-dusky.

In the young there is even greater variation than in the adults. Two Brazilian specimens vary as follows: One is uniform, very dark blackish sepia above, the back being as dark as, and very little different from, the crown; the jugulum is everywhere barred, both in the white on the upper portion, and in the rufous of the lower part, while the bars of the lower parts are very regular and narrow, upon a white ground, almost exactly as in the adult. The other specimen has the back dull rufous (as in the adult), and the crown dull brownish-slate, in strong contrast;

the sides of the breast are rufous, the jugulum is unbarred, and the bars of the lower parts are broad, distant, and brownish-black upon a buff ground.

There can be no question as to the proper specific name of this species, the *Sparvius ruficollis* of Vieillot, and the *Falco xanthothorax* of Temminck being unmistakably the adult in the rufous plumage. Whether the *Sparvius gilvicollis* of Vieillot is this bird in its gray plumage (=*M. leucauchen*, Scl. and Salvin, *nec Falco leucauchen*, Temm.?), is a question which can only be decided by reference to Vieillot's type, should it yet exist. It probably is this bird, however, or the one which we name *M. pelzelni* (see p. 494), for it certainly is not the *M. concentricus* of Pelzeln, as we fully demonstrate under the head of that species.

The *Falco leucauchen* of Temminck cannot be identified with certainty from his figure or description. The latter comes near the young of the rufous phase of the present species, while the specimens of the latter have usually been labelled with that name. *As we recollect them*,[1] the specimens in the museum of the Philadelphia Academy, which were called *M. leucauchen*,[2] agree exactly with a specimen now before us, belonging to Mr. Salvin's collection, and which we regard as unquestionably the young of the plumbeous phase of *M. ruficollis*, called by Sclater and Salvin *M. leucauchen*. But notwithstanding all these circumstances, which together favor the probability of the correctness of the identification, there are several points in Temminck's plate which cannot be reconciled to the young of the species under consideration, although it is fair to presume that these discrepancies may have resulted through a faulty representation of the type specimen. Upon examining this figure it will be noticed that the first character which attracts attention is the stripe of white spots over the eye, on each side of the crown, and down each side of the nape. These markings we cannot find in any specimens of *ruficollis*; while the latter have a distinct *nuchal* collar of white spots, not represented in the plate. The crown in this figure is colored rusty brown, like the back, whereas in *ruficollis* it is either plumbeous or, as is very rarely the case, blackish. The plate fails to show, too, the well-defined half-crescent behind the brownish ear-coverts,

[1] Unfortunately we have now no opportunity of comparing them.

[2] See Proceedings of the Boston Society of Natural History, XVI, May, 1873, pp. 35, 40.

which is so marked a feature in the young of *M. ruficollis.* While "les plumes blanches qui composent cette bland cervicale sont *terminées de noir ;* le sommet de la tête *et de l'occiput sont noirs ;* le dos, le croupion et les ailes d'un brun sombre, *et les remiges rayées de noirâtre*"—is a description which will scarcely apply to any specimens we have seen. The bird is unmistakably a *Micrastur*, but that it is undoubtedly this species we are by no means convinced.

The following specimens, in the collection of Mr. Osbert Salvin, have been examined and measured :—

	Wing.	Tail.	Culmen.	Tarsus.	Middle toe.
ADULTS.					
Plumbeous phase.					
Bahia	6.50	7.30	.55	2.40	1.15
"	6.80	....	.60	2.40	1.15
Rufous phase.					
	6.80	7.30	.55	2.45	1.18
Bahia	7.10	7.80	.62	2.45	1.20
Rio Janeiro	6.60	7.30	.55	2.40	1.15
YOUNG.					
Plumbeous phase.					
Bahia	7.00	7.50	.60	2.35	1.20
Rufous phase.					
Brazil	6.60	7.00	.58	2.30	1.20
Rio Janeiro	7.00	7.80	.65	2.35	1.30

6. MICRASTUR PELZELNI, nov. sp.

Micrastur pelzelni, Ridgway, MSS.

Sp. Char. Wing longer than the tail ; tail crossed by 3 light bars, including the terminal one. Adult ♂ (in collection Osbert Salvin, Jarayacu, Upper Ucayali, Peruvian Amazons, August 2, 1865 ; E. Bartlett): Above uniform continuous dark plumbeous. Tail darker, narrowly tipped with white, and crossed by two narrow bands of dull brownish-gray, becoming white on the inner webs. Side of head and neck plumbeous-gray ; throat light gray. Rest of lower parts white, *everywhere* marked with very narrow transverse bars of dark plumbeous or slate; these bars widest on the breast, but even here narrower than the white; on the flanks and crissum they are paler, very narrow, and distant. Wing, 6.50; tail, 6.30; culmen, .60; tarsus, 2.30; middle toe, 1.20.

Remarks.—This species most closely resembles *M. guerilla* in its plumbeous phase, to which it is so very similar that we had referred it to that species, not making much, at the first comparison, of the smaller number of tail-bands. But after measuring carefully all the specimens of *M. guerilla*, and finding that the minimum length of tail in that form is 6.90 inches, ranging thence to 7.50, and always greater than the length of the wing, we were quite surprised to find the tail of this specimen to be only 6.30 in length, or decidedly shorter than the wing, which, as were also the other parts, was about as in the average of *M. guerilla*. In abbreviated tail it is like *M. concentricus*, and it appears that Mr. Salvin had referred it to that species, since the label bore in his handwriting the name "*M. gilvicollis*," as did also a true *M. concentricus* in the collection; but it differs very essentially in the relative length of the lateral toes, the outer one being decidedly longer than the inner, instead of barely equal to it, or appreciably shorter; while the barred crissum and under wing-coverts distinguish it at a glance from that species.

This may possibly be the *M. gilvicollis* of Pelzeln[1] (*loc. cit.*), but the latter is very much more likely to be the plumbeous phase of *M. ruficollis*, called by Sclater and Salvin *M. leucauchen*, and by

[1] "M. pileo, capitis et colli lateribus, nucha, dorso, uropygio alisque supra cinereaceis, remigibus brunneis, parte basali pogoniorum internorum albo transversim striatis, alarum tectricibus inferioribus albis, brunneo transverse fasciolatis, gula albescente grisea, jugulo, pectore et abdomine albis, dense brunneo transverse fasciolatis (fasciis 6–8 in singula pluma), abdomine imo, corporis lateribus, tibiarum plumis et caudæ tectricibus inferioribus ejusdem coloris fasciis rarioribus, angustioribus, caudæ rectricibus nigrescente-brunneis apicibus albis, fasciis transversis albis angustis tribus æquidistantibus, rostro corneo basi flavo, pedibus flavis. Longit. 13½–14″, alæ 6, 9–10‴, caudæ 6½–7″, rostri a rictu 9–11‴, tarsus 2″, 3–4‴.

Avis juvenis differtis notaeo obscure brunneo, uropygii plumis punctis albis notatis, genis brunneo et ochraceo variegatis, fascia transversa alba utrique infra genas versus nucham ducta cum nuchæ plumis albo-maculatis collare interruptum formantibus, gula alba, gastræo pallide ochraceo fasciis brunneis multo rarioribus et angustioribus, caudæ fasciis tribus interruptis et passim obsoletis.

Sharpe the "adult male" of *M. ruficollis.* We quote Pelzeln's remarks as given in the "Ornithology of the Novara," pages 10 and 11.

"*Micrastur gilvicollis* steht *M. concentricus* sehr nahe, aber seine Flügel sind kürzer, der Schwanz ist zeimlich bedeutend länger. Die Farbe des alten Vogels ist lichter, mehr aschgrau, die Binden der Unterseite sind schmäler und dichter gestellt und erstrecken sich auch über die Unterschwanzdecken; der Schwanz zeigt an den Individuen jedes Alters und Geschlechtes ausser dem Endsaume drei wiesse Binden, welche am jungen Vogel und an dem aus Cayenne schmal, unterbrochen und hie und da verloschen, an dem alten Männchen und dem Weibchen von Borba breiter und sehr hervortretend sind. Die dunkeln Querstreifen verschwinden an den beiden Vögeln in Übergangskleide am Unterbauch, den Seiten, den Unterschwanzdecken und Tibienfedern gänzlich oder sind nur schwach angedeutet. Bei allen Exemplaren, ausser dem von Cayenne, ziegen die Innenfahnen der Schwungfedern, ausser den weissen Querbinden gegen die Basis zu, bis nahe gegen die Spitze hin ähnliche oberhalb lichtbraune, unterhalb weisse, woven bei *M. concentricus* nur an einem oder dem anderen Exemplare schwache Andentungen zu sehen sind. Am alten Männchen von *M. gilvicollis* nähern sich die vorderen Schuppen der Tarsen sehr der Schilderform."

7. Micrastur concentricus.

??? *Falco concentricus*, Illiger, Mus. Berol.

??? *Nisus concentricus*, Less., Tr. Orn.

Climacocercus concentricus, Cabanis, in Erich. Archiv, 1844, I, 265; in Tschudi Fauna Peruana, 18, 98 (white belly and lower tail-coverts!); in Schomb. Reise Br. Guiana, III, 735.

Micrastur concentricus, Pelz., Orn. Nov. 1865, 9; Orn. Braz., I, 1868, 399.—Ridgw., Pr. Boston Soc N. H. XVI, Dec. 1873, p. 81.

Falco senex, Natterer, in Mus. Vindob. (*fide* Pelzeln).

Micrastur gilvicollis, Scl. & Salv. P. Z. S. 1869, 368 (not *Sparvius gilvicollis* Vieill., 1817).—Nom. Av. Neotr. 1873, 120.—Sharpe, Cat. Acc. Br. Mus. 1874, 78.

Hab. Tropical South America, from New Granada and Trinidad to Peru (Bolivia?) and Brazil. Brazil (*Mus. Boston Soc.*), Amazonia (*Am. Mus., N. Y.*), ? Bolivia (*D'Orb.*), Bahia, Guiana, Rio Negro and Rio Janeiro (*Pelzeln*); Capiru River, Parà, Bogota, and Trinidad (*Sharpe*), Cayenne (*Mus. O. Salvin*).

Sp. Char. Wing, 7.10–7.75; tail, 6.30–7.00; culmen, .60; tarsus, 2.25–2.45; middle toe, 1.00–1.08. Adult: Above uniform plumbeous; tail, blackish-dusky, narrowly tipped with white, and crossed 3–4 narrow bars, or lines, of the same. Beneath white, the throat sometimes faintly tinged with ashy, the breast and sides with narrow transverse bars of dusky, *anal region*, *crissum*, *and lining of the wing*, *always immaculate*.

Remarks.—This very distinct species may be immediately distinguished by the peculiar proportions of the lateral toes, and by having the tail shorter than the wing; while in its adult dress it is unique in the white thoat and unbarred crissum and anal region, as well as by the yellowish instead of dusky color of the bill, though we are not sure of the constancy of the latter feature.

The shade of plumbeous of the upper parts generally inclines to brownish posteriorly, and becomes more bluish toward the head, especially on the neck; the feathers of the lower half of the rump are white, tipped with plumbeous.

A specimen from Cayenne, in Mr. Salvin's collection, has not only the parts described, but also the abdomen, flanks, and tibiæ, unbarred; the crown is decidedly darker than the back, and the neck has a very perceptible bluish cast. Other peculiar features mark this as a young bird in transition plumage.

The proper name for this species is involved in considerable uncertainty from the difficulty of ascertaining just what bird two of the older authors—Vieillot and Lesson—had in view when they described their *Sparvius gilvicollis* and *Nisus concentricus*. Herr von Pelzeln (Orn. Nov. p. 10) identifies in the former the bird which we describe as the plumbeous phase of *M. ruficollis*, while the latter he considers to be the bird now under consideration. Messrs. Sclater and Salvin, however, differ from Herr Pelzeln (Proc. Zool. Soc., 1859, p. 368), and regard these two names as synonymous, basing their opinion on the fact that M. Pucheran had compared the types of each, then in the Paris Museum, and had pronounced them indentical; and *gilvicollis* being the older of the two names, Messrs. Sclater and Salvin accordingly adopted that for the present bird. We are not so ready, however, to accept M. Pucheran's conclusions as a final settlement of the point, for the bird which Vieillot describes as *Sparvius gilvicollis* is certainly *not* this bird, and the error of this indentification becomes at once apparent upon reading Vieillot's description, which is as follows, the points of disagreement with the characters of the present bird being italicized :—

" L'Épervier *a gorge cerdrée.* 9. S. Gilvicollis. S. suprà cærulescente-griseus ; *gulâ cinereâ* ; corpore subtus fusco alboque transversìm striato ; *rostro fusco ;* pedibus flavis.

" D'un gris-bluatre en dessus ; *gorge cendrêe ;* dessous du corps rayé en travers de brun et de blanc ; *bec brun ;* pieds jaunes.

" Cet oiseau, que nous avons vu au muséum d'histoire naturelle, en dont nous ne connoissons pas le pays natal, est d'un gris-bleuâtre sur toutes les parties superieures; *cendrée sur la gorge ;* rayé en travers de brun et de blanc sur le devant du cou *et sur les parties posterieures* ; on remarque sur le dessous des pennes caudales, quarre lignes blanches, étroites er transversales ; le que est d'une longueur moyenne."

It will be seen from the above that *Sparvius gilvicollis*, Vieillot, had a gray throat, a dusky bill, and posterior lower parts barred, so that it is impossible to indentify it with this bird, whose diagnostic features consist in a white throat, and immaculate white posterior lower parts.

Whether *Nisus concentricus* of Lesson is this species can only be determined by examination of the type specimen, if it exists. Should it have become lost or destroyed, the name ought to be altogether ignored, since the briefness of the description renders it wholly impossible to tell what species is meant ; while it is also probable that two are included. This description is as follows :—

" Épervier a quatre lignes ; *Nisus concentricus : Falco concentricus*, Illig.

" Le tour des jeux est nu ; l'occiput le dos, le manteau, les ailes, sont d'un bleu ardoisé ; la queue est très-courte, brunâtre et blanchâtre, les parties inférieures sont blanchâtres, cerclées de brun sur la poitrine et sur le ventre ; le bec et les tarses sont jaunes.

" La femelle a la tête, le cou, d'un gris efumé, ainsi que le dos et les ailes ; les parties inférieures sont grises, rayées finement de brun. Cette espèce habite Cayenne, d'où l'a rapportée M. Poiteau. (Mus. de Paris.)" [Lesson, Traité Oìs., I, 1831, 60.]

From this description alone, it is absolutely impossible to tell what species is meant, but the clause "*le bec et les tarses sont jaunes*," renders it somewhat probable that the bird is the same as that which Herr Pelzeln identified as *M. concentricus*.

There can be no doubt, however, that the present bird is the

Micrastur concentricus of Pelzeln; but whether that gentleman is right in his identification of Lesson's description, we are not able to decide; but, for the benefit of those who may have an opportunity to examine Lesson's type, we will say, that, should it have the outer toe not perceptibly longer than the inner,[1] the conclusion is correct, for the bird now under consideration differs essentially *from every other one of the genus in this remarkable respect.* Should there be no way of deciding this point by examination of Lesson's type, the species might be called *M. concentricus*, PELZELN, which name we feel justified, under the circumstances, in adopting. Pelzeln's description of this species is as follows:—

"M. pileo, capitis et colli lateribus, nucha, dorso et uropygio schistaceis, alis supra concoloribus sed magis brunnescentibus, remigibus brunneis parte basali pogoniorum internorum albo transverse fasciolatis, gula grisco-alba, jugulo, pectore et abdomine albis brunnes transverse fasciolatis (faciis 5–7 in singula pluma), abdomine imo, corporis lateribus et tibiarum plumis ejusdem colons fasciis rarioribus angustioribus, belricibus caudal inferioribus albis haud fasciatus, caudæ rectricibus nigres centibus apicibus albis fasciis transversis angustis albis duabus, una versus basin altera medium collocata, vel (solummodo in individuis nonnullis adultis) fascia unica post medium sita, rostro corneo interdum basi, interdum apice flavo, pedibus flavis. Longit $13\frac{1}{2}$ usque 14″, alæ $6\frac{3}{4}$–7″, caudæ $6\frac{1}{4}$, rostri a rictu 10–12‴, tars. 2″ 3–4‴.

"Avis junior differtis fascia transversa albo brevi utrinque infra genas versus nucham ducta, pectore et abdomine ochraceo-lavatis fasciis brunneis multo rarioribus et angustioribus, abdomine inferiore, corporis lateribus et tibiarum plumis fasciis nullis." [Orn. Nov. 1865, 9.]

There is but one feature in Pelzeln's description of his *M. concentricus* which does not accord with our *concentricus*, and that is the number of bands on the tail, which are stated to be from one to two, besides the terminal one, whereas in the specimens of our bird which we have seen, amounting in all to eight examples, the number varies from three to four! Should it be possible that there are two species with immaculate white lower tail-coverts, it

[1] The *claw* is not included; see figs. 8 and 9, pp. 481, 482.

should be borne in mind that our bird has the inner toe (exclusive of the claw) elongated to beyond the third joint of the middle toe, instead of falling considerably short of it, as in *M. guerilla*, *M. ruficollis*, and *M. zonocercus*, as well as the two larger species, while the outer toe extends no further, if as far, as the inner one. (See fig. 9, p. 482.)

It is quite likely, however, that a large number of tail-bands is characteristic of younger, and fewer bands distinctive of older birds, there probably being, as in *M. mirandollii*, but little difference between the plumage of the old and young. A circumstance in favor of this supposition is that a specimen in Mr. Salvin's collection having four bands on the tail, besides the terminal one, shows several strong signs of immaturity, the bill being yellow, the feathers of the under parts, particularly the flanks and crissum, having a fluffy downy texture, while those of the sides have a strong ochraceous tinge. In addition to these suggestive peculiarities, a single feather on the breast, of the new molt, has wider and more numerous bars than the others, they numbering 7 besides the basal gray, while on the others there are but 5.

Pelzeln. describes the young (first plumage) as differing in having a short transverse bar of white behind the cheeks and extending towards the nape, the breast and abdomen washed with ochraceous and fasciated with distant and narrow bars of brown, the lower part of the abdomen, the tibiæ, and the sides of the body without bars. The first feature is plainly visible in the bird before us, in a quite well-marked white crescent behind the ear-coverts, while it also has the sides, abdomen, and tibiæ unbarred, besides having a distinct ochraceous wash under the wings.

Specimens Examined.—Mus. Philad. Acad. 5; Boston Soc. 1; N. Y. Mus. 1; O. Salvin, 1. Total 8.

APPENDIX.

Biographical notes on M. melanoleucus.

The late Colonel Andrew J. Grayson, well known as an indefatigable collector and observer of birds on the western coast of Mexico, thus describes the habits of this species:—[1]

[1] On p. 299 of "Birds of Western and Northwestern Mexico. Based upon Collections made by Col. A. J. Grayson, Capt. J. Xantus, and Ferd. Bischoff. By George N. Lawrence." <Memoirs Boston Soc. Nat. Hist., Vol. II., pt. iii., No. ii., pp. 265-319.

"Among the great variety of hawks to be met with in a single day's excursion in the locality of Mazatlan, none are so easily recognized as this peculiar and interesting species. I have only found it in the heavy forests, or the immediate vicinity of a thickly wooded country, where its slender form and lengthened tail attract our attention as it swiftly glides through the tangled woods, with that remarkable ease which we have often noticed in the sharp-shinned hawk (*A. fuscus*). It appears to be strictly arboreal in its habits, and possessed of wonderful activity, either in springing from branch to branch without opening its wings, or rapidly darting through the intricacies of the brush with apparently but little difficulty. I have seldom seen one of these hawks in an open country, and have never seen one flying higher than the tree tops, where they are met with. Its wings are rather short, and its flight is performed by rapidly repeated strokes, only for a short distance at a time. It preys upon various species of wood birds, which it captures by darting upon them on the ground or in the bushes; but the Chachalaca [*Ortalida wagleri*] is its favorite game; this is a gallinacious bird, or wild chicken, about the size of, or lighter than the common hen, and is entirely arboreal, seldom running upon the ground, but is able by its peculiarly formed feet to cling to, or spring rapidly through, the thickest branches with great agility; but this hawk follows it with equal facility, until an opportunity offers to strike its prey, then both come to the ground together, the hawk being the lighter bird. I witnessed a scene of this kind that took place when I was endeavoring to get a shot at a Chachalaca, as it was jumping about the very thick branches of an acacia, overgrown with lianes; it appeared to be in great distress, uttering its harsh notes of alarm, and spreading its fan-shaped tail; suddenly I saw one of these hawks pounce upon it, when with harsh screams of terror and pain the Chachalaca dragged his captive to the ground, where they struggled for a few moments, but the unfortunate bird was soon overcome. The struggling and screams of the Chachalaca created a great commotion among the denizens of the woods; far and near were heard the harsh cries of other members of its family, and the Urraca Magpie [*Calocitta colliei*] with streaming tail and ludicrous gesticulations, as well as the Blue-back Jay [*Cyanocitta beecheyi*], and other birds in the neighborhood, gathered around to witness the scene of rapine; suddenly appeared in the midst of this clamor a larger hawk (*Buteo harrisi*, Aud.), which rushed at once upon the captor of the Chachalaca; unable to withstand so heavy a charge, he was compelled to give up his honestly captured prey to a superior force, thus proving the old adage that 'might is right.' The slender but compact figure of our present subject was now seen perched upon a neighboring bough, scrutinizing with a vicious eye the more powerful but less active bird of prey, as he vainly attempted to bear off the lifeless form of the Chachalaca; but there was one yet mightier than he: I observed it for a few moments, then shot it, as also the long tailed Hawk, thus securing all three.

"They build their nest of dry twigs and moss, which is placed in a very tall tree; therefore, I regret that I am unable to describe the eggs."

Dr. Samuel Cabot in the Boston Journal of Natural History, Vol. IV. pp. 462–464, describes this bird under the name of *Falco percontator*, or Calling Falcon, from its loud calling note, said to be louder and more frequently uttered just before a storm.[1] It is also described as having the boldness and dash of a falcon or true hawk (*Nisus*), one of them having swooped at a boat-bill which he killed while flying across a stream, while another was observed to chase a dove while on the wing.

[1] Dr. Cabot says the Indians believe that this is "because its bones ache."

The following reports were read and referred to the Publication Committee:—

REPORT OF RECORDING SECRETARY.

The Recording Secretary respectfully reports that during the year ending November 30th, 1875, forty-two members and eleven correspondents have been elected.

Four members have resigned.

The following members have died: Rev. Henry S. Spackman, Dr. G. W. Norris, Dr. A. A. Henderson, U. S. N., Dr. R. Bannan, U. S. N., and William E. Whitman. The deaths of Sir Charles Lyell and John Edward Gray, correspondents, were also announced.

Twenty-seven papers have been presented for publication as follows: Edw. D. Cope, five; R. Ridgway, three; Elliot Coues, three; Thos. G. Gentry, three; W. G. Binney, two; H. R. Morrison, two; T. A. Conrad, Dr. Jas. Lewis, E. L. Berthoud, Aug. R. Grote, J. A. Ogden, H. C. Chapman, R. E. C. Stearns, B. F. Lautenbach, and O. A. L. Mörch of Copenhagen, each one. Twenty-one of these were ordered to be published in the Proceedings, four in the Journal, one was withdrawn at the request of the author, and one remains yet to be reported upon.

In addition to the above contributions to the Proceedings and Journal, the verbal communications made at the several meetings and published in the Proceedings without being formally referred to committees, have been unusually numerous and important. Those by Dr. Leidy upon the results of his recent microscopical investigations, by Prof. Cope upon the Palæontology of the west and kindred subjects, and by Mr. Thos. Meehan upon vegetable physiology deserve special mention. Interesting verbal communications have also been made by Prof. Frazer, Dr. Chapman, Prof. B. Waterhouse Hawkins, C. Newlin Peirce, Chas. A. Young, Wm. M. Gabb, Geo. Koenig, and Jos. Willcox.

During the year the concluding thirty pages of the Proceedings for 1874 and 427 pages of the current volume have been published, the latter being illustrated by twenty-four lithographic plates and ninety wood-cuts. 187 pages of the Journal have also been issued before the completion of the illustrative plates as advance copies of Prof. Cope's paper on the Batrachia and Reptilia of Costa Rica.

Abstracts of such parts of the proceedings of the Academy as might be of popular interest have been published from time to time in the daily papers, with the effect, it is believed, of increasing the interest of the community at large in the welfare of the society, as well as causing a more numerous attendance of members at the meetings.

Art II. Chap. II. of the By-laws was amended by striking out the last sentence and substituting the following words: "Persons under sixteen years of age may be elected members provided their nominations be first approved by the Council. Members under the legal age of twenty-one years are not entitled to vote at any meeting of the Academy nor to serve on committees."

On August 31, a resolution was adopted requesting the Council to examine the By-laws and report such changes as may be necessary for the better government of the Academy.

The important events in the history of the Academy during the past year have been the reception of the I. V. Williamson Library Fund more particularly referred to in the Librarian's Report, the sale of the premises at present occupied by the society, the removal of the collections to the new building at the S. W. corner of Nineteenth and Race Streets, and the junction of the American Entomological Society with the Academy as a section thereof.

On February 23, a resolution was adopted referring to the Finance Committee for consideration, a proposition to subscribe the sum of $50,000 to the building fund of the Academy. On March 30, a report was received from the committee recommending the appropriation of the sum named upon certain conditions, and a resolution was adopted authorizing the Treasurer to make the subscription when a further sum of $30,000 had been obtained. A resolution was also adopted authorizing a committee appointed at a previous meeting to ascertain the value of the premises at Broad and Sansom Streets, to negotiate the sale of the same. On November 16, this committee reported that the property had been sold for $60,000 to be paid in cash and securities, amounting together it was believed in net value to $56,500, and on November 23, the President and Recording Secretary were authorized and directed to transfer the property according to legal form to the purchaser, Moro Phillips, Esq.

At the meeting held May 11, a letter was received from the American Entomological Society inquiring on what terms that Society might be allowed to occupy the apartments to be devoted to Entomological purposes in the new building. A committee was appointed to consider the subject in conjunction with a similar committee from the American Entomological Society. At the next meeting of the Academy a report was received and adopted embracing a plan of union by which it was proposed that the American Entomological Society should become a Section of the Academy. On Oct. 19, the Committee presented a plan of union drawn up in legal form, which was referred to the Council for consideration. Certain amendments proposed by the latter body having been accepted by the American Entomological Society, on Nov. 9, the officers of the Academy were directed to ratify the Articles of Agreement. Properly certified copies of these Articles have been accordingly deposited in the archives of both societies.

On November 2, the new building having been so far completed as to be ready for the reception of the collections of the Academy, the President announced that the process of moving had been commenced on that day.

All of which is respectfully submitted.

EDWARD J. NOLAN,
Recording Secretary.

REPORT OF LIBRARIAN.

There were 1940 additions made to the library from January 1 to November 30, 1875; being an excess of 280 for the eleven months named over the number received during the twelve months of the preceding year.

Of these 565 were volumes, 1368 pamphlets and parts of periodicals, and 7 maps, charts, etc.; 1534 were octavos, 300 quartos, 76 folios, and 9 maps.

They were derived from the following sources:—

Societies	525	Geological Survey of India	4
Editors	335	War Department	3
I. V. Williamson Fund	269	Jos. Barnett	3
Rathmell Wilson	170	Geological Survey of Penna.	2
Authors	137	Geological Survey, Ohio	2
C. F. Parker	113	Publishers	2
Wilson Fund	87	Jos. Jeanes	1
Department of the Interior	25	Rev. Jas. Saul	1
Howard Potts	21	Louis Wagner	1
Isaac Lea	13	Jos. Willcox	1
Engineer Department, U. S. A.	11	Edw. D. Cope	1
Henry Wheatland	9	Geo. W. Tryon, Jr	1
S. S. Haldeman	7	Minister of Public Works, France	1
Thos. Meehan	7	Treasury Department	1
Regents of University, New York	6	City of Phila	1
Government of India	6		

In addition to the above, 174 were paid for from the general funds of the Academy.

The additions to the library were distributed to the several departments as follows:—

Journals	1364	Physical Science	11
Geology	138	Education	11
General Natural History	84	Voyages and Travels	10
Conchology	84	Bibliography	10
Ornithology	47	Mammalogy	10
Botany	44	Ichthyology	7
Entomology	34	Herpetology	7
Anatomy and Physiology	28	Biography	6
Mineralogy	28	Chemistry	3
Helminthology	12	Politics	2

224 volumes have been bound during the year, and 51 are now in the hands of the binder. For the expenses of binding as well as for the amounts paid for the books from the several funds, you are respectfully referred to the report of the Treasurer of the Academy.

The card catalogues of the works on Geology, Mammalogy, and Ornithology, amounting in the aggregate to 2753 titles exclusive of cross references, have been completed and the system of numbering extended to those departments. This work has been somewhat retarded during the past month by the fear that it would be impossible to preserve exactly the same arrangement of the books on the shelves of the library in the new building. Any disturbance of the order in which the numbered volumes are at present placed will, of course, render necessary some revision of the catalogue, and it has been thought well to avoid this as far as possible. The numbering and card register will be extended to the remaining sections of the library as rapidly as possible after the rearrangement of the books in the cases provided in the new building has been perfected.

At the meeting of the Academy held February 16, The Treasurer announced the munificent donation by Isaiah V. Williamson, Esq., to the Academy of ground rents to the amount of $25,000.00 as a permanent fund for the use of the library. It is confidently hoped that the interest on this sum, together with the portion of the interest derived from the legacy of the late Dr. Thos. B. Wilson devoted to the same use, and amounting together to $1800.00 per annum, will be sufficient, not only to keep the library supplied with the current scientific literature, but also to enable the Library Committee to secure from time to time the many very desirable books of an earlier date which are still wanting in most of the departments. It will be perceived that 269 additions to the library have been already derived from the I. V. Williamson Fund. The most notable of these additions is a complete set of Curtis' Botanical Magazine, which was long most earnestly desired by the society. It may be well said to constitute a comparatively complete botanical library in itself.

A number of answers to the applications for deficiencies sent last year to corresponding societies have been received since my last report, and in many cases the volumes applied for have been sent to the Academy. I have great pleasure in acknowledging the obligations of the society to Mr. Wm. S. Vaux, who, during his recent visit to Europe, lost no opportunity of pressing our wants upon the attention of the officers of such societies as he had an opportunity of visiting. We have received, in consequence, valuable contributions from the Academy of Sciences of Bologna, of Naples, of Bruxelles, and from the Zoological Society of London. I have also been advised of the early sending of a valuable series of volumes of the Comptes Rendus of the French Academy, in which the library has been deficient since the death of our benefactor Dr. Thos. B. Wilson, and which, together with parts of the Annales des Mines, and other desiderata, have been secured directly through the agency of Mr. Vaux.

The thanks of the Academy are also specially due to Mr. Rathmell Wilson for the liberal donation of 170 volumes from the library of his brother, the late Dr. Thos. B. Wilson. Some of these were already in the possession of the Academy, but the collection contains many valuable works not before in the library, while most of the duplicates are in better condition than the copies on our shelves.

All of which is respectfully submitted.

EDWARD J. NOLAN, *Librarian.*

REPORT OF THE CURATORS FOR 1875.

The Curators, in presenting their usual annual report, announce the important fact that the new building, erected for the Academy at the corner of 19th and Race Sts., is so far completed as to be ready for the reception of its collections. Indeed, the removal of the Museum from the building we now occupy was commenced on the 2d of November and was completed the last week. It is proposed shortly to commence the removal of the Library, and the Curators anticipate having our new hall ready for the future meetings of the Academy early in January of the coming year. The removal of the Museum was carried on with unexpected rapidity, but with the necessary care, under the able direction and incessant attention of two of my colleagues, Mr. Tryon and Mr. Parker. Indeed, I feel that the Academy is greatly indebted to these two gentlemen for the successful manner in which they have carried out this responsible charge, and I hope that we may be still able to secure their services for the necessary arrangement of the Museum in our new building.

During the last year an unusual amount of labor was carried on in putting the collections of the Museum in the best condition for study.

The ornithological collection, which, from its enormous size, is the most serious charge of the Curators, has suffered in past years a considerable amount of damage from the attacks of insects. Latterly, much attention has been devoted to it, and we hope hereafter to be able to keep it in better condition. During the last year Dr. James A. Ogden, Mr. Russell Hill, and Miss Sarah P. Monks, have been engaged in arranging the collection. In this time they have identified, labelled, and catalogued 6900 specimens of birds, of about 1300 species comprised in 38 families.

The alcoholic specimens generally of the Museum have been looked over by Mr. Parker.

The alcoholic collection of mollusks, myriapods, spiders, etc., comprising about 500 jars, have been arranged and labelled by Mr. Parker.

All the crustaceans, amounting to upwards of 1050 species, have been identified, neatly arranged, labelled and catalogued by Mr. Parker and Mr. Tryon.

The collection of echinoderms has been properly arranged and labelled by the same gentlemen.

All the specimens received during the year have been deposited in their proper places and labelled.

The Botanical Committee, Messrs. Meehan, Burke, and Redfield, and Miss Bodley and Dr. Leffman, have continued their labors in the arrangement of the Herbarium.

The contributions to the Museum during the year are as follows:—

Mammals.—A Giraffe; a Virginia Deer; a Rock Kangaroo, *Petrogale penicillata;* a Porcupine, *Hystrix javanicus;* a young Lion; 2 *Sciurus;* 2 *Pauxi galeata; Macacus nemestrinus; Cercopithecus sabæus:* and a Sapajou. Presented by the Philadelphia Zoological Society.

A Japanese Dog, from Dr. W. S. W. Ruschenberger; a Howling Monkey, *Mycetes*, U. S. of Columbia, from Wm. M. Gabb; a Maryland Marmot, from Dr. Harrison Allen; and a small mammal from Fung Chow, China, from Wm. M. Capp. Eleven human skulls were presented by Dr. William H. Jones, U. S. N.

Birds.—*Crax carunculata*, S. America; Red-breasted Pigeon, *Phlogaenas cruenta:* Philippines; *Casarca variegata*, N. Zealand; and *Porphyrio martinica.* Presented by the Philadelphia Zoological Society.

Fifteen specimens, 9 species, of bird skins, mostly from Guaymas and La Paz, and another collection of 28 bird skins, from the Pacific coast. Presented by Dr. Wm. H. Jones, U. S. N.

A Gray Duck, *Chaulelasmus streperus*, from C. W. Matthews, and an Ostrich egg, from S. C. McClure.

Reptiles, Amphibians, and Fishes.—An Alligator. Presented by the Philadelphia Zoological Society.

Two small bottles with reptiles; three additional species of reptiles, and 33 specimens of 19 species of fishes, from the Pacific coast of Mexico, from Acapulco to Guaymas and La Paz. Presented by Dr. Wm. H. Jones, U. S. N.

Five species of reptiles, Cold Springs, N. York, and one reptile, from California. Presented by Sarah P. Monks.

A fine specimen of *Ceratodus Forsteri*, from Queensland. Presented by Dr. John Belisario, of Sydney, Australia, through Dr. McQuillen.

A Bottle-headed Dolphin, *Coryphæna Suerii*, caught five miles off the coast of Atlantic City, N. J., Sep. 7, 1875. Presented by W. R. Bucknell.

An Angel Fish, *Squatina Dumerili*, from Lewes, Delaware. Presented by A. Purvis.

Two species of reptiles and four of fishes, from Chester Co. Presented by Dr. H. Allen.

Trichiurus lepturus, from the southeast coast. Presented by John Krider.

Spelerpes bilineata. Presented by Gen. Pleasanton.

Bolesoma olmstedii, Rancocas Creek, N. J. Presented by Col. T. M. Bryan.

Two snakes from Fung Chow, China. Presented by Wm. M. Capp.

Mollusks.—Fifty-one species of marine shells, from the Atlantic coast of Costa Rica; three species, from Aspinwall; three specimens *Ostrea virginica*, from Gulf of Nicoya; and a Helix from Genesee Co., N. Y. Presented by William M. Gabb.

Thirty species of shells, from Acapulco, besides three other collections of shells and bryozoans, from Alaska and other localities along the Pacific coast to Mexico. Presented by Dr. Wm. H. Jones, U. S. N.

Seventeen species of land shells from Australia, West Indies, etc., presented by Thomas Bland; and also four additional species, in exchange from the same.

Three cuttle fishes, from China. Presented by Wm. M. Capp.

Twenty-one species of shells, from Florida. Presented by W. W. Calkins.

Eighteen species of shells, from California, presented by Sarah P. Monks; two species *Bulimus* and two of *Thaumastes*, from the Rio Negro and the Amazon, presented by Prof. J. Orton; *Goniobasis potosiensis*, from Missouri, presented by Mrs. Mary P. Harris;

and a small collection of shells, from Bermuda, presented by Mr. Janney.

Articulates.—A case containing a fine collection, mainly of lepidoptera, with a few neuroptera, from the coast ranges at Rockingham Bay, northeast coast of Queensland, Australia. Presented by Dr. John Belisario, of Sydney, N. S. Wales, through Dr. McQuillen.

Many specimens of species of crustaceans, besides *Carpilius maculatus*; two species of barnacles; a small collection of isopods and insects. From various localities of the Pacific coast, and presented by Dr. Wm. H. Jones, U. S. N.

A bottle of insects, from Ooromia, Persia. Presented by a missionary, Rev. G. W. Coan, through Mr. D. D. Willard.

Three vials with insects, from Nebraska. Presented by Lieut. W. L. Capenter, U. S. A.

Ocypoda rhombea: several spiders and centipeds; several species of ants; and parasites from a monkey, a field-mouse, a hawk, and a beetle, from Old Harbor, Costa Rica. Presented by W. M. Gabb.

Libinia canaliculata, Cape May, N. J., from Rev. R. B. Port; an Astacus, Chester Co., from Dr. H. Allen; *Epeira riparia*, Philadelphia, from Miss Withers; a Mole-cricket, California, from Miss Monks; and a wasp's nest, Haddonfield, N. J., from Miss Mary Kirby.

Radiates and Protozoans.—A collection of echinoderms, holothurians, ophiurians, and star-fishes; an actinia, a coral, a gorgonia, and several species of acalephs; from the Pacific coast. Presented by Dr. W. H. Jones, U. S. N.

Five species of corals, one star-fish, and five species of sponges, from Bermuda. Presented by Mr. Janney.

Eleven species of corals and an *Echianthus rosaceus*, from Florida. Presented by W. W. Calkins.

A collection of British sponges: *Grantia compressa*, *Isodictya varians*, *I. infundibuliformis*, *Chilina oculata*, and *Halichondria panicea*. Presented by the Liverpool Free Public Museum.

Two species ophiurans and one other echinoderm, from Aspinwall, and a coral from the coast of Costa Rica. Presented by Wm. M. Gabb.

A fine specimen of *Heterocentrotus mammillatus*, from the Pacific. Presented by J. H. Redfield.

Erechinus chloroticus, New Zealand. Presented by C. F. Parker.

Fossils.—A large collection of tertiary fossils, of St. Domingo, comprising 1340 specimens of mollusks, and 86 specimens of 23 species of corals. Presented by William M. Gabb.

Several collections of fossils from the marl pits near Vincenttown, Pemberton, Ayrestown, and Glassboro, New Jersey, comprising a multitude of specimens of vertebræ, and teeth of sharks of the genera Lamna, Otodus, Carcharodon, Oxyrhina, and Galeocerdo; also teeth of Pristis, Myliobatis, and Enchodus; the snouts of Histiophorus and Coelorrhynchus; in addition, fragments of turtle shells, of Mosasaurus and other saurian bones, dermal plates, bones and teeth of crocodiles, etc. Specimens also of Belemnites, Ammonites, Ostrea, several gastropods, Spatangus, etc. Presented by Col. T. M. Bryan. There were likewise presented by the same gentleman, some fossil fishes, mollusks, and plants, from Colorado.

A small collection of shark teeth and a cetacean rib, from Ashley R., S. C. Presented by S. T. Abert, through Col. Bryan.

A collection of seventy-five fossils, from the vicinity of Lexington, Scott Co., Md., was presented by Dr. W. D. Hutchings.

A collection of forty-four fossils, from California, was presented by Sarah P. Monks.

A collection of teeth and vertebræ of sharks, from Ashley R., S. C., and a collection of post-pliocene fossils, from the coast of Cuba, were presented by Mr. John Ford.

Other small collections and single specimens of fossils were presented by Dr. S. C. De Besy, W. W. Jefferis, J. B. Dillingham, Alfred G. Baker, John M. Hartman, Joseph P. Hazard, C. J. Hardekopf, Joseph Krall and Dr. F. L. Gault.

From the Otago Museum, Dunedin, N. Z., there was received a collection of bones of Dinornis, in exchange.

From the Museum of the Jardin des Plantes, Paris, there was also received, in exchange, a collection of casts in plaster, of vertebrate fossils.

Plants.—One hundred and eighty-nine species of plants, collected in the Sierra Nevada, California, by Lemmon, were presented by Messrs. John H. Redfield, John S. Haines, and Thomas Meehan.

A collection of Parry's plants of Wyoming and of Southern Utah of 1873–74 was presented by Wm. H. Dougherty.

A collection of plants, from Guadalonpe Island, off Lower California, was presented by John H. Redfield and Wm. M. Canby.

A collection of plants from Vera Cruz, was presented by Chas. Mohr, of Mobile, Ala.; another from California and Nevada, was presented by Dr. J. W. Metcalf; and one of eleven species of algæ, of California, was presented by Miss Sarah P. Monks.

Single botanical specimens were presented by Dr. Robert Bridges, Botanelly & Co., G. Schrader, J. S. Lippincott, and Dr. J. L. LeConte.

Minerals.—A meteorite, which fell Feb. 12, 1875, near Homestead, Iowa, was presented by C. W. Irish, Iowa City.

A large and magnificent specimen of amethyst, from Thunder Bay, Lake Superior. Presented by W. S. Bissel.

Idocrase, Orange Co., N. Y.; two arkansites, Magnet love, Ark.; martite, Digby Neck, N. Scotia; apatite, Nassau; pyrite, Bannat; and calcite, Cornwall. Presented by C. S. Bement.

A large pebble of limpid quartz, from Siberia. Presented by Joseph Jeanes.

Melanosiderite, chesterlite, jefferisite, and halite, from Chester and Delaware Co's. Presented by W. W. Jefferis.

Native silver and argentite, argentite, and pyrargyrite, Guanajuata, Mexico. Presented by Dr. A. B. Carothers, Saltillo, M.

A small collection of minerals from Fritz's Island, near Reading, Pa., and a specimen of samarskite, from Mitchell Co., N. C., were presented by Joseph Willcox.

Other minerals were presented as follows:—

Five specimens of cinnabar, St. John's Mine, Solano Co., Cal., and lignite from Alaska, by Dr. Wm. H. Jones; malachite, from Australia, by Dr. J. Belisario; stilbite on gneiss, Frankford, Pa., by John Ford; arkansite on quartz, by Dr. Beadle; several iron ores from York Co., Pa., and Essex Co., N. Y., by John M. Hartman; fossil wood, Cecil Co., Md., by J. Ryder; agate pebbles, Texas, by Lieut. A. C. Mackley; lignite, Costa Rica, by Wm. M. Gabb; peat, New Jersey, by John Cooper; bog ore, Edgmont, Del. Co., by A. B. Mitchell; limonite with impression of recent snake skin, Carroll Co., Va., by Mr. Huey through Dr. James Darrach; opalized wood, Nebraska, by Swarthmore College; and sulphur, California, by Miss Sarah P. Monks.

Miscellaneous.—Tapa cloth, Feejee Is., presented by Dr. John

Belisario; and a collection of bows and arrows, from one of the Pacific Isles, presented by Dr. Wm. H. Jones, U. S. N.

Respectfully submitted by

JOSEPH LEIDY,
Chairman of the Curators.

REPORT OF RECORDER OF BIOLOGICAL AND MICROSCOPICAL SECTION, 1875.

In presenting to this Section the annual Report of the Recorder, I am gratified to be able to make it a mere record of scientific research actually accomplished; and believe we have ample cause for mutual felicitation in the fact, that no single meeting throughout the year has passed without its written or oral communication, illustrated in every instance save one by specimens of microscopic work.

At the first meeting in 1875, Dr. J. G. Hunt made a very interesting communication upon the subject of Amplifiers for the microscope, giving a history of the apparatus, and demonstrating the mode of employment and special advantages. At the February meeting, Dr. J. C. Morris read his elaborate report upon $\frac{1}{25}$ and $\frac{1}{50}$ objectives, full abstracts of which have been since reprinted in the "Cincinnati Medical News," and in the "London Monthly Microscopical Journal." In March an instructive article on "The misinterpretation of appearances under the microscope," by Mr. Charles Stodder, of Boston, Mass., a correspondent of the Section, was read and afterwards appeared in the columns of the "Phila. Medical Times." At the next meeting, Dr. Carl Seiler produced an important paper on the "Photographic enlargement of microscopic objects," illustrated by numerous photographs taken with an ingenious camera of his own construction, which he also displayed. In May, an exhaustive article on the "Physiological action of hemlock and its alkaloids," was presented by Dr. H. C. Wood, for B. F. Lautenbach, M.D.; and Dr. J. G Hunt exhibited some of his exquisite preparations, of injected intestinal villi of the rabbit, and Pacinian bodies from the mesentery of the cat, giving minute directions for following his method of manipulation. At the first meeting after the summer vacation, Dr. Hunt showed some sections from the branch of a pear tree affected with "black rot" or "fire blight" which gave rise to a discussion on parasitic disease; in November, Dr. Richardson read a paper on "Improved method of applying the micro-spectroscopic test for blood stains," demonstrating its application to a spot of blood only $\frac{1}{100}$ of an inch in diameter; and our present December gathering is marked by the valuable article of Dr. Carl Seiler on "Microscopic Photography with High powers," to which we have just listened with so much interest.

The greatest triumph of the year was of course the Annual Exhibition of microscopes, microscopic specimens, and apparatus, which was given in the Hall of the Academy on the 4th of October last. Under the chairmanship of Dr. J. L. LeConte, this display was eminently successful, and, being witnessed and appreciated by a large audience of ladies and gentlemen, has doubtless in some measure contributed to raise our parent Academy in popular estimation. Indeed, I think that the obvious illustrations under our microscopes at these Exhibitions, of every day uses to which science is applied, constitute valuable means of convincing the community at large that our labors, our objects, and our aims in the study of the natural sciences, are practical and utilitarian; instead of being, as too many still believe, chiefly theoretical and speculative.

All of which is respectfully submitted.

Jos. G. Richardson, *Recorder.*

REPORT OF THE RECORDER OF THE CONCHOLOGICAL SECTION.

The Recorder of the Conchological Section reports that during the year ending Dec. 21st, a number of donations to the museum have been received, all of which have been labelled and arranged. For list of these see the Report of the Curators of the Academy of Natural Sciences. The marine shells of the Swift Collection, which had been placed with Dr. O. A. L. Mörch, of Copenhagen, for identification, have also been received, but, as there was no room for them in the cases, they have not been unpacked. All the alcoholic specimens of mollusks have been relabelled.

For numerous additions to the Library see report of the Librarian of the Academy.

During the year papers have been accepted and published in the Proceedings of the Academy aggregating 120 pages text and 24 plates, as follows:—

Wm. G. Binney,	114 pages	text and	21 plates.
James Lewis,	4 "	" "	1 plate.
T. A. Conrad,	1 page	" "	1 "
Wm. M. Gabb,	1 "	" "	1 "

By a resolution adopted at a special meeting of the Section held April 27, last, three thousand dollars were subscribed to the building-fund of the Academy, and this amount has been paid to its Treasurer; and by another resolution, adopted at the last meeting of the year, the sum of $500 was appropriated towards defraying expenses for shell cases in the new museum building.

The officers of the Section for 1876 are as follows:—

Director	W. S. W. Ruschenberger, M.D.
Vice-Director . . .	Geo. W. Tryon, Jr.
Recorder	S. Raymond Roberts.
Secretary	Rev. E. R. Beadle.
Librarian and Conservator	Edw. J. Nolan, M.D.

Respectfully submitted by

S. R. ROBERTS, *Recorder*.

The election of Officers for 1876 was held in accordance with the By-laws, with the following result:—

President . . .	W. S. W. Ruschenberger, M.D
Vice-Presidents . .	Wm. S. Vaux, J. L. Le Conte, M.D.
Recording Secretary .	Edward J. Nolan, M.D.
Corresponding Secretary	Edward D. Cope.
Treasurer . . .	Wm. C. Henszey.
Librarian . . .	Edward J. Nolan, M.D.
Curators . . .	Jos. Leidy, M.D., Wm. S. Vaux, Geo. W. Tryon, Jr., Chas. F. Parker.

Publication Committee .	Jos. Leidy, M.D.,
	Wm. S. Vaux,
	Geo. W. Tryon, Jr.,
	W. S. W. Ruschenberger, M.D.,
	Geo. H. Horn, M.D.
Council	R. S. Kenderdine, M.D.,
	Edw. S. Whelen,
	Robt. Bridges, M.D.,
	Geo. H. Horn, M.D.
Finance Committee. .	Aubrey H. Smith,
	Wm. S. Vaux,
	Robt. Bridges, M.D.

ELECTIONS DURING 1875.

MEMBERS.

January 26.—J. M. Patterson, Dr. Alex. Muckle, Wm. V. McKean, Nicholas Lennig, Chas. A. Young, H. J. Fagen.

February 23.—J. Towers Pennypacker, Peter F. Rothermel, Chas. E. Hall.

March 30.—Mrs. Caroline G. Taitt, Miss Rebecca Gibson, Jacob P. Jones, James S. Mason, Geo. Cochrane, U. S. N., Wm. H. Castle.

April 27.—Ellicott Fisher, J. S. Alexander.

May 25.—John M. McGrath, M.D., J. Warner Edwards, F. Odin Horstman, Wm. G. Platt, Miss Mary Jeanes, Miss Anna T. Jeanes, Wm. Williamson, M.B., Charles Sumner Williamson.

June 29.—Isaac Hinckley.

July 27.—Howard A. Kelly, George Milliken, Jas. B. England.

August 31.—Wm. Wallace Goodwin, Adolph W. Miller, M.D., Rev. H. C. McCook.

September 28.—Samuel G. Lewis, Eugene Santee, M.D., Stephen Greene.

October 16.—William M. Davis, Jr., B. F. Stephenson, M.D., U.S.N.

November 30.—J. B. Knight, Elliston P. Morris, R. Shelmerdine McCombs, M.D., John C. Boyd, M.D., U. S. N., Eli K. Price.

December 28.—Wm. Stevenson, Beulah M. Rhoads, George Wood, H. C. Humphrey, Joseph H. Roach.

CORRESPONDENTS.

April 27.—Col. T. M. Bryan, of Vincenttown, N. J.

May 25.—Dr. John Belisario, of Sydney, N. S. W.

June 29.—Prof. Luigi Bombecci Porta, of Bologna; Prof. Paolo Mantovani, of Rome.

October 26.—Prof. Karl A. Zittel, of Munich; Prof. Wilhelm C. H. Peters, of Berlin.

November 30.—Prof. William Henry Flower, F.R.S , of London. Dr. Albert Günther, of London; Prof. St. George Mivart, F.R.S., of London; N. S. Maskelyne, F.R.S., of London; Prof. George Rolleston, F.R.S., of Oxford, England.

CORRESPONDENCE OF THE ACADEMY.

For 1875.

January.—N. N. Bruyn, with proposals for exchange of specimens.

Le Secrétaire-Archiviste de la Société d'Agriculture, d'Histoire Naturelle et des Arts utiles de Lyons, acknowledging receipt of publications.

G. M. Barnes, on behalf of the San Diego, Cal., Society of Natural History.

February.—Die Naturforschende Gesellschaft in Berne, acknowledging receipt of publications.

Miss M. C. Montfort, desiring exchange of specimens.

Die Schweizerische Gesellschaft für die gesammten Naturwissenschaften, Bern, acknowledging receipt of, and transmitting publications.

University of the State of New York;

Die Naturforschende Gesellschaft in Zürich; Société des Sciences Naturelles de Neuchatel; severally acknowledging receipt of publications.

Gesellschaft zur Beförderung der gesammten naturwissenschaften in Marburg;

Die Kaiserliche Akademie der Wissenschaften, Wien;

La Société des Sciences de Finlands; all transmitting publications.

March.—F. H. Pipes, with information in regard to a mastodon.

Alex. Wilcocks, acknowledging receipt of notice of election as member of a committee.

A. J. Siler, acknowledging election as correspondent.

Dr. F. Fayrer, acknowledging receipt of notice of election as correspondent.

Literary and Philosophical Society of Liverpool;

Bergens Museum, Norway;

Linnean Society, London; severally acknowledging receipt of publications.

April.—J. L. Lyons, in regard to a rattlesnake.

W. W. Hollenbush, acknowledging receipt of notice of election as correspondent.

Directeur du Jardin Impérial de Botanique, St. Petersburg, with publications.

Die Gesselschaft der naturforschende Freunde zu Berlin;

Nassauischen Vereins für Naturkunde, Wiesbaden;

Buffalo Society of Natural Sciences;

Lyceum of Natural History of New York;

Smithsonian Institution, Washington;

Essex Institute, Salem; severally acknowledging receipt of publications.

May.—J. W. Dawson, in regard to publications.

Prof. F. V. Hayden, in relation to publications of Geological Survey of the Territories.

Col. T. M. Bryan and M. C. Cook, severally acknowledging receipt of notice of election as correspondents.

Asiatic Society of Japan, with publications.

Königl. Böhmische Gesellschaft der Wissenschaften in Prag;

Die Naturforschende Gesellschaft in Danzig;

Yale College; severally acknowledging receipt of publications.

A. T. Goshorn, Director of the Centennial Commission, inclosing letter from Thos. J. Wright.

June.—J. K. Hoyt, in relation to Helminthophaga Lawrencii, Herr.

Cyrus Thomas, in relation to price of Proceedings.

Wm. M. Wilson, with resignation.

Leeds Philosophical and Literary Society;

Royal Geographical Society of London; severally acknowledging receipt of publications.

Det Kongelige norske Videnskabers-Selskab i Throndhjem;

Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique;

Die Kaiserliche Akademie der Wissenschaften zu Wien; severally acknowledging receipt of, and accompanying publications.

K. k. zoologisch-botanishe Gesellschaft, Wien;

Die Pollichia; severally with publications.

A. Moret, from La Ronce, France, with reference to a prize essay on Moral and Political Science.

July.—P. P. Carpenter, in relation to facilities for study of the Chitonidæ.

Der Verein für Naturw. Unterhaltung im Hamburg, with publications.

Boston Society of Natural History;

Literary and Philosophical Society of Liverpool;

Essex Institute, Salem;

Smithsonian Institution, Washington;

Royal Society of Tasmania; severally acknowledging receipt of publications.

August.—G. Moret, in explanation of prize essay.

C. W. Irish, accompanying a piece of the Iowa meteorite.

Edw. Berthoud, with essay.

Statistical Society of London, acknowledging receipt of publications.

September.—Linnean Society, London, acknowledging receipt of publications.

Masonic Academy, Milton, Florida, desiring publications.

Messrs. Porter and Coates, Philadelphia, requesting information about the Academy.

October.—Belfast Naturalists' Field Club, with publications.

Benj. V. Marsh, with donations to museum.

November.—Wm. S. Schofield, with request for title conferred on members.

Saturday Evening Post, with request for cut of new building.

University Library, Cambridge;

Leeds Philosophical and Literary Society; severally acknowledging receipt of publications.

Die Naturforschende Gesellschaft zu Halle;

Der Zoologisch-Mineralogische Verein zu Regensburg; severally with publications.

December.—K. Zittel, of Munich, and

W. Peters, acknowledging election as correspondent of the Academy.

Societá Adriatica di Scienze Naturali in Trieste;

Königliche Universitäts Bibliothek zu Wurtzburg;

K. Universitäts und Landes-Bibliothek, Strassburg;

Smithsonian Institution, Washington;

Société Hollandaise des Sciences à Harlem;

Yale College, New Haven; severally acknowledging receipt of publications.

Die Bibliothek der k. Bayerischen Akademie der Wissenschaften, München, acknowledging receipt of, and transmitting publications.

Directeur du Jardin Imperial de Botanique, St. Petersburg;

L'Inst. Royale Meteorologique des Pays-bas à Utrecht;

K. Universitätsbibliothek, Wurtzburg;

Dorpater Natur. Gesellschaft; severally with publications.

Which is respectfully submitted by

E. D. COPE,
Corresponding Secretary.

ADDITIONS TO THE LIBRARY 1875.

Abert, J. J. Report in reference to the Canal to connect the Chesapeake and Ohio Canal with the City of Baltimore. 1838. Washington. From the Engineer Department.
Adams's Contribution to Conchology, Nos. 1, 3-7. Rathmell Wilson.
Allen, Harrison. Studies in the Facial Region. Philadelphia. The Author.
Allen, J. A. Notes on the Mammals of portions of Kansas, Colorado, Wyoming, and Utah. Henry Wheatland.
Annual Report (Twentieth) of the Board of Directors of the Lehigh Valley Railroad Company to the Stockholders, January 19, 1875. The Company.
Annual Report of the Librarian of Congress, Washington, 1874. The Author.
Atkinson, John. A Compendium of the Ornithology of Great Britain, with a reference to the Anatomy and Physiology of Birds. London. S. S. Haldeman.
Audebert's Singes et Makis. Rathmell Wilson.
Aughey, Prof. Samuel. Catalogue of the Flora of Nebraska, published by the University of Nebraska. Lincoln, 1875. Jos. Willcox.
Baird, S. F. United States Commission of Fish and Fisheries. Part II. Report of the Commissioner for 1872 and 1873. Washington. The Author.
Balfour, Prof. The Botanist's Companion. Edinburgh. Purchased.
Bancroft, H. H. The Native Races of the Pacific States. Vol II. Civilized Nations. Vol. III. Myths and Language. Vol. IV. Antiquities. New York. I. V. Williamson Fund.
Barcena, Mariano. Datos por el Estudio de la Rocas Mesozoicas de Mexico. Mexico, 1875. The Author.
Descripcion de un Crustacea Fosil del genero Spheroma. Mexico, 1875. The Author.
Bastiat, Frederick. Essays on Political Economy. London. 12mo. Cobden Club.
Bate & Westwood's History of British Sessile-Eyed Crustacea, pp. 64-400. Rathmell Wilson.
Becker, Bernard H. Scientific London. New York. Purchased.
Becker, Lothar. Der Bauerntabak eine Pflanze der Alten Welt. The Author.
Bedriaga, Jacques v. Ueber die Entstehung der Farben bei den Eidechsen. Jena, 1874. I. V. Williamson Fund.
Bentham, George. Handbook of the British Flora. 2 vols. London, 1865. Purchased.
Bentley, Robt. A Manual of Botany. 1873. I. V. Williamson Fund.
Bergh, Dr. Rud. Reisin im Archipel der Philippinen von Dr. C. Semper. 2es Theil Wissenschaftliche Resultate. 2es Band, Malacologische Untersuchungen. IX Heft. Weisbaden, 1875. Wilson Fund.
Berkley, Rev. M. J. Outlines of British Fungology. 1860. I. V. Williamson Fund.
Bernardi's Galatea et Fischeria. Rathmell Wilson.
Bernardi's Monographie du Genre Conus. Rathmell Wilson.
Betta and Martinati's Molluschi di Venete. Rathmell Wilson.

Binney's Conchological Writings of Say. Rathmell Wilson.
Binney, W. G. Notes on American Land Shells. Vol. II., Part III. Burlington, N. J. G. W. Tryon, Jr.
Bischoff's Lepodosiren paradoxa, 1840. Rathmell Wilson.
Bland, Thos. Notes on certain Terrestrial Mollusks, with Descriptions of New Species. The Author.
Bleeker, P. Atlas Ichthyologique des Indes Orientales Neerlandaises. Liv. 27. Amsterdam. Wilson Fund.
Boddaert's Tables des Planches Enluminees. Folio Manuscript. Rathmell Wilson.
Boeck, Prof. Dr. W. Erfaringer om Syphilis. 8vo. Christiania. The Author.
Undersgolser Angaaende Syphilis. 4to. Christiania. The Author.
Boies, A. H. Catalogue of the Birds ascertained to occur in Southern Michigan, 1875. The Author.
Boisduval et Guenée, MM. Suites à Buffon. Insectes Lépidopteres. Tome 1. Texte and Planches, 1 Liv. 1874. Wilson Fund.
Bolton, H. C. Proceedings of the Centennial of Chemistry. Philadelphia, 1875. H. C. Bolton.
Bonney's Geology. 1874. I. V. Williamson Fund.
Bourguignat, M. J. R. Monographie du nouveau genre française Montessieria. Wilson Library.
Mollusques noveaux litigieux ou peu connus. 5–9 Fasc. Rathmell Wilson.
Bowden, Rev. J. The Naturalist in Norway. London. Purchased.
Bowerbank, J. S. A Monograph of the British Spongidæ. Vol III. Ray Society Vol. for 1874. Wilson Fund.
Brewster, William. Some Observations on the Birds of Ritchie County, West Virginia. The Author.
British Encyclopædia, Ninth Edition. Vols. 1 and 2. Purchased.
Broadhead, G. C. Report of the Geological Survey of the State of Missouri, including the field work of 1873–74, G. C. Broadhead, State Geologist. The Survey.
Broca, Paul. Revue d'Anthropologie publiée sous la direction de M. Paul Broca. Tome 3me. The Editor.
Bronn, Dr. H. G. Klassen und Ordnungen des Their-Reiches. 6er Band. V. Abth. 4, 5, 6, 7, 8 Lief. Leipzig, 1874–5. Wilson Fund.
Brot, M. A. Description du Nouvelles espéces de Mélaines. Rathmell Wilson.
Brühl, Carl Bernhard. Zootomie aller Thierklassen für Lernende nach Autopsien. Atlas, Lief I., II. and III. Wien, 1874. Purchased.
Brunton, T. Lauder, and J. Fayrer. On the Nature and Physiological Action of the Poison of Naja tripudians and other Indian venomous snakes. Parts 1, 2, 3. Dr. Fayrer.
Brush, George J. Manual of Determinative Mineralogy. New York. I. V. Williamson Fund.
Brusina, Spiridion. Fossile Binnen Mollusken aus Dalmatien Kroatien und Slavonien. Augram. The Author.
Buckland, Frank. Log book of a Fisherman and Zoologist. 8vo. London, 1875. I. V. Williamson Fund.
Buckley, S. B. First Annual Report of the Geological and Agricultural Survey of Texas. Houston, 1874. The Author.
Campana, Dr. Recherches d'Anatomie, de Physiologie et d'Organogénie pour la determination de Lois de la Genese et de l'Evolution des Especès Animales. Paris, 1875. I. V. Williamson Fund.

Carus, J. V., and C. E. A. Gerstæcker. Handbuch der Zoologie. 1er Band. II. Hälfte. Purchased.
Catalogue of Books added to the Library of Congress, 1872. The Librarian.
Catalogue of Plants collected in the years 1871–2–3, with descriptions of new species. U. S. Geol. Surv. of Ter. Dep. of Interior.
Cazellus, Dr. M. E. Outlines of the Evolution Philosophy. New York. Purchased.
Census of the Madras Presidency. Vols. I. and II.
Census of the Bombay Presidency. Vols. I. and II. Madras and Bombay, 1874–5. The Government of India.
Circulars of Information of the Bureau of Education. Nos. 1–6, 1875. Washington. Department of Interior.
Claparede and Lachmann's Infusores and Rhizopods. 2 vols. 4to. Rathmell Wilson.
Clark, W. S. Observations on the Phenomena of Plant Life. Boston. The Author.
Clift, Wm. Notice on the Megatherium brought from Buenos Ayres by Woodbine Parish. London. Prof. Haldeman.
Cooke, G. H. Annual Report of the State Geologist of New Jersey. 1874.
Cooke, Josiah P., Jr. Melanosiderite, etc. The Author.
Cooke, M. C. Fungi, their Nature and Uses. Edited by Rev. M. J. Berkeley. New York. Purchased.
Same. The Author.
Cope, E. D. Consciousness in Evolution. Philadelphia, 1875. The Author.
Department of Interior, Report of United States Geological Survey of Territories. F. V. Hayden. Vol. II. The Vertebrata of the Cretaceous Formations of the West. Washington, 1875. The Author.
On the Cretaceous and Tertiary Reptilia and Fishes. November, 1870.
On Three extinct Astaci from the Fresh-water, Territory of Idaho. December 16, 1870.
On some species of Pythonomorpha from the Cretaceous Beds of Kansas and New Mexico. December 18, 1870.
Note of some Cretaceous Vertebrata in the State Agricultural College of Kansas. October 20, 1871.
On Bathmodon, an extinct Genus of Ungulates. January, 1872.
Third account of New Vertebrata from Bridger Eocene of Wyoming Valley, 1872.
On some Eocene Mammals, obtained by Hayden's Geological Survey of 1872–73.
On two new Perissodactyles from the Bridger Eocene, 1871.
The extinct Vertebrata of North Carolina. The Author.
On some new Fossil Ungulata. The Author.
Report on the Vertebrate Palæontology of Colorado. Washington. The Author.
Synopsis of the Vertebrata of the Miocene of Cumberland County, N. J. The Author.
Systematic Catalogue of the Vertebrata of the Eocene of New Mexico, collected in 1874. The Author.
Coues, Elliott. Abstract of Results of a Study of the Genera Geomys and Thomomys. Washington. The Author.
Birds of the Northwest. Washington. Department of Interior.
Department of Interior, United States Geological Survey of the Territories. Birds of the Northwest: A Handbook of the Ornithology of the region drained by the Missouri River and its tributaries. Washington. The Department of the Interior.

A List of the Birds of New England. Henry Wheatland.
United States Northern Boundary Commission, Natural History, No. 1. On the Muridæ. The Author.
Cox, E. T. Sixth Annual Report of the Geological Survey of Indiana, made during the year 1874. Indianapolis, 1875. The Author.
Crépin, François. Description de quelques plantes fossiles de l'Etage des Psammites du Condroz. Bruxelles. The Author.
Croll, James. Climate and Time in their Geological Relations. London, 1875. I. V. Williamson Fund.
Dana, J. D. Appendixes to Dana's Mineralogy, I., II. I. V. Williamson Fund.
Manual of Geology: treating of the principles of the science with special reference to American Geological History. Second Edition. Purchased.
Notice of the Chemical and Geological Essays of S. S. Hunt. The Author.
On Dr. Koch's Evidence with regard to the Contemporaneity of Man and the Mastodon in Missouri. The Author.
On Serpentine Pseudomorphs and other kinds, from the Tilly Foster Iron Mine, Putnam County, New York. The Author.
Zoophytes. 1838–42. Rathmell Wilson.
Darwin, Charles. Insectivorous Plants. New York, 1875. I. V. Williamson Fund.
Davies, Thomas. The Preparation and Mounting of Microscopic Objects. Second Edition. London. I. V. Williamson Fund.
De Buch's Pétrifications recueillies en Amérique. 1839. Rathmell Wilson.
De Borre, A. P. de. Notes sur des Empreintes d'Insectes fossiles découverts dans les Schistes Houillers des Environs de Mons. The Author.
De Quatrefages, A. Natural History. New York. Purchased.
De Saussure, Henri, et Julius Sichel. Catalogus specierum generis Scolia 8vo. Geneva. The Authors.
De Saussure, Henri. Notice Biographique sur Edward Reni Claparede. Geneva. The Author.
Desor, E. et L. Favre. Le Bel Age du Bronze Lacustre en Suisse. Paris, 1874. Purchased.
Dodel, Arnold. Die Neuere Schöpfungsgeschichte nach dem gegenwärtigen Stande der Naturwissenschaften. Leipzig. Purchased.
Dorhn, Anton. Der Ursprung der Wirbelthiere und das Princip des Functionswechsels. Geneologische Skizzen. Leipzig. Purchased.
Drouet's Mollusques Marines des Isles Açores. Paris, 1858. Rathmell Wilson.
Nayades de la France, 1852–57. Rathmell Wilson.
Dumeril et Bibron. Suites à Buffon. Reptiles Planches. Rathmell Wilson.
Dunbar, Jas. Essays on the History of Mankind. Second Edition. 8vo. London. Prof. Haldeman.
Dunker's Mollusca Japonica. 1861. Rathmell Wilson.
Dunker and Zittel. Palæontographica. 20er Band. 8e Lief. 2e Abth. 6e Lief. 21er Band. 6er Lief. 22er Band. 6e Lief. Cassel. Wilson Fund.
Dupuy's Mollusques du Gers. Rathmell Wilson.
Drysdale, Dr. John. The Protoplasmic Theory of Life. London, 1874. I. V. Williamson Fund.
Dybowsky's Krebse aus dem Gruppe der Grammariden. Published by the Entomological Society of Russia. The Society.
Edinburgh Encyclopædia. American Edition. 21 vols. Howard Potts.

Elsberg, Louis. Regeneration, or the preservation of Organic Molecules. Salem, 1874. The Author.

Eyton, T. C. Osteologia Avium ; or a Sketch of the Osteology of Birds. 2 vols. and Supplement I., II. Nos. 1, 2, 3. I. V. Williamson Fund.

Fayrer, J. The Royal Tiger of Bengal, his Life and Death. London, 1875. The Author.

Ferussac. Tableaux Systematiques des Animaux Mollusques. Paris. Rathmell Wilson.

Finsch, Dr. O. Die Vogel Ost-Afrikas. Leipzig, 1870. I. V. Williamson Fund.

Fiske, John. Outlines of Cosmic Philosophy. 2 vols. Boston, 1875. I. V. Williamson Fund.

Forsyth, James W. and F. D. Grant. Report of an Expedition up the Yellowstone River, made in 1875. War Department.

Francis, Dr. Samuel. Curious Facts concerning Man and Nature. Part Second. The Author.

Frazer, Persifor, Jr. Tables for the determination of Minerals, translated from the German of Weisbach. The Translator.

Friedlander's Catalogue. Berlin, 1874. The Publishers.

Friedmann, Alexander. Officieller Bericht über das Marine wessen auf der Weltausstellung, 1873. 8vo. Vienna. The Author.

Fries' Lichenes Arctoi Europa Groenlandiaque hactenus cogniti. Rathmell Wilson.

Fromentel, E. de. Etudes sur les Microzoaires, Fasc. 2. Paris. I. V. Williamson Fund.

Fürstenberg's Krätzmilben, 1861. Rathmell Wilson.

Galton, Francis. Englishmen of Science; their Nature and Nurture. New York. Purchased.

Gannett, Henry. List of Elevations principally in that portion of the United States west of the Mississippi River. Third Edition. Washington. Department of Interior.

Garlick, Theodatus. A Treatise on the Artificial Propagation of Fish. New York. Purchased.

Garman, S. W. Description of a new species of North American Serpent. The Author.

On the Skates (Rajæ) of the Eastern Coast of the United States. The Author.

Gassies' Mollusques de l'Agenais. R. Wilson.

Gaultierius' Index Testarum, 1742. R. Wilson.

Gegenbaur, Carl. Morphologisches Jahrbuch. 1er Band. 1er Heft. Leipzig. Purchased.

Gervais, Paul. Zoologie. Tome III. No. 5. Paris, 1874. Purchased.

Giebel, Dr. C. G. Thesaurus Ornithologia. 4er Halbband. Leipzig, 1875. I. V. Williamson Fund.

Glover, Townsend. Manuscript Notes from my Journal, or Illustrations of Insects, Native and Foreign. Diptera, or two-winged Flies. Washington, D. C., 1874. The Author.

Goette, Dr. Alexander. Die Entwickelungsgeschichte der Unke. 1 vol. 8vo. and atlas. Purchased.

Gordon, George. The Pinetum. Second Edition. London. Purchased.

Gould, J. Monograph of Toucans. Rathmell Wilson.

Gras' Mollusques de l'Isère. Rathmell Wilson.

Gray, Asa. Revision of the Genus Symphoricarpus. The Author.

Gray, George Robert. Hand-List of Genera and Species of Birds, distinguishing those contained in the British Museum. Part III. London, 1871. I. V. Williamson Fund.

Gray, J. E. Obituary notice of.
List of the Books, Memoirs, and Miscellaneous Papers by Dr. John Edw. Gray. The Author.
Grube's Ausflug nach Triest und dem Quarnero. Rathmell Wilson.
Guide to Belfast and the adjacent Counties. Prepared by the Belfast Naturalists' Field Club. The Society.
Günther, Dr. Albert. Catalogue of the Acanthopterygian Fishes in the Collection of the British Museum. Vol. 3. London, 1871. I. V. Williamson Fund.
Haldeman's Univalve Mollusca. Nos. 1–8. Rathmell Wilson.
Hanley, Sylvanus. Conchologia Indica. Edited by Sylvanus Hanley and William Theobold. Part 7. Wilson Fund.
Hart, John. A description of the Skeleton of the Fossil Deer of Ireland. Second Edition. Dublin. Prof. Haldeman.
Hartt, Ch. Fred. and R. Rathbun. On the Devonian Trilobites and Mollusks of Eré, Province of Pará, Brazil. The Authors.
Hartt, Ch. Fred. Notes on the Manufacture of Pottery among Savage Races. The Author.
Hartwig, G. The Aerial World. New York. Purchased.
Hayden, F. V. Annual Report of the United States Geological Survey of the Territories, embracing Colorado, being a report of progress of the Exploration for the year 1873. Department of Interior.
Henshaw, H. W. Annotated List of Birds of Utah. Salem, 1874. The Author.
Hentz, N. M. Occasional Papers of the Boston Society of Natural History. II. Hentz's Spiders of the United States. 1875. The Society.
Hermann, Ernst. Das Central-Nerven System von Hirudo medicinalis. München, 1875. I. V. Williamson Fund.
Hermannsen's Indicis Generarum Malacozoorum Supplementa et Corrigenda. 1852. Rathmell Wilson.
Herrick, Harold. A Partial Catalogue of the Birds of Grand Menan. Henry Wheatland.
Hewitson, Wm. C. Exotic Butterflies. Parts 89–96. Purchased.
Hitchcock, C. H. The Geology of New Hampshire. C. H. Hitchcock, State Geologist, and J. H. Huntington, Principal Assistant. Vol. I. Concord. The Survey.
Hooker, J. D. The Flora of British India. Parts I., II. and III. London, 1872–4. Secretary of State, India.
Hugo, le Cte. Leopold. La Question de l'Equidomoide et des Cristalloides géométrique. The Author.
Hume, Allen. Nests and Eggs of Indian Birds. Rough Draft. Parts II. and III. Calcutta. The Author.
Hyatt, Alpheus. The Jurassic and Cretaceous Ammonites collected in South America by Prof. James Orton.
Biological Relations to the Jurassic Ammonites.
Genetic Relations of the Angulatidæ.
Remarks on the Genera of Ammonites. The Author.
International Exhibition, 1876. List of Principal Useful or Injurious Mammals. Edw. D. Cope.
Irish, C. W. An account of the Detonating Meteor of February 12, 1875. Iowa City. The Author.
Jaeger, Dr. Gustav. In Sachen Darwin's insbesondere contra Wigand. Stuttgart. Purchased.
James, U. P. Catalogue of Lower Silurian Fossils of the Cincinnati Group. The Author.

Jan, M. le Prof. Iconographie générale des Ophidiens. 46me Livr. November, 1874. Wilson Fund.

Jay's Catalogue of Shells. Fourth Edition. 1859. Rathmell Wilson.

Johnson's New Illustrated Universal Cyclopædia. Vol. 1. New York. Purchased.

Jones, W. A. Report upon the Reconnoissance of Northwestern Wyoming, including Yellowstone National Park, made in the summer of 1873. With Appendix. Washington, 1875. War Department.

Just, Dr. Leopold. Botanische Jahresbericht. Herausgegeben von Dr. Leopold Just. 1er Jahrg (1873) 1er and 2er Halbband. Berlin, 1874. Purchased.

Kenngott's Ueber die Meteoriten, 1863. Rathmell Wilson.

Uebersicht der resultate Mineralogischer Forschungen im Jahren 1856–7, 8–9–60. Rathmell Wilson.

Kjerulf, Theodore. Om Skuringsmærker, Glacial-formationen, Terrasser og Strandlinier samt om grundfjeldets og sparagmit fjeldets mægtighed i Norge. Christiania, 1873. R. Norway Acad. of Science.

Klinggraff, Dr. C. J. v. Zur Pflangengeographie des nördlichen und Arktischen Europas. Marienwerder, 1875. I. V. Williamson Fund.

Kiener's Coquilles Vivants. Plates of Turbo and Trochus, plates and text of Turritella, Scalaria, Solarium Rotella, Delphinula, Phasianella, Tornatella, Pyramidella, and Thracia. Rathmell Wilson.

Koch, Dr. L. Aegyptische und Abyssinischen Arachniden gesammelt von Herr C. Jickeli. Nürnberg. Purchased.

Kock, Dr. G. von. Anatomie der Orgelkoralle (Tubipora Hemprichii, Ehrbg.) Jena, 1874. I. V. Williamson Fund.

Koldeway, Captain. The German Arctic Expedition of 1869-70. London, 1874. I. V. Williamson Fund.

Kolliker, Albert. Die Pennatulide umbellula und zwei neue typen der Alcyonarien. Wurzburg. Physico-Medical Society.

Krause, Johann Heinrich. Pyrgoteles oder die edlen Steine der Alten im Bereiche der Natur und der bildenden Kunst. Halle. Jos. Jeanes through Dr. Leidy.

Krenner, Dr. Jos. Alex. Die Eishöhle von Dobschau. 4to. Budapest. Hungarian Nat. Hist. Soc.

Krohn's Pteropoden und Heteropoden. Rathmell Wilson.

Kummer, Paul. Der Führer in die Lebermoose und der Gefässkryptogamen. Berlin. Purchased.

Kunth, C. S. Enumeratio Plantarum. Vol. V. Stuttgart. Wilson Fund.

Kuster, H. C. Systematisches Conchylien-Cabinet von Martini und Chemnitz. Ier Band, 80 Heft; IIIer Band, Heft 34, 36, 40; IVer Band, 14, 15, 16, 17; IXer Band, 28, 30 Heft. Wilson Fund.

Lacordaire et Chapuis' Insectes Coléoptères. Collection des Suites à Buffon. Tome XI. Planches 12 Livr. Paris, 1875. Wilson Fund.

La Menagerie du Museum National. 1–8 Livr. Rathmell Wilson.

Lea, Isaac. Description of New Unio. List of Publications, etc. Four Pamphlets. Rathmell Wilson.

Observations on the Genus Unio. Vol. VIII. Rathmell Wilson.

Index to Vol. I.–XIII. Observation on the Genus Unio. Vol. III. The Author.

Ledebour, Dr. Carlo Fredrico a. Flora Rossica sive Enumeratio Plantarum in Totius Imperii Rossici. 4 vols. 8vo. Stuttgartiæ. Purchased.

Lesley, G. P. Second Geological Survey of Pennsylvania, 1874. B. & J. Harrisburg. The Survey.

Lesquereux, Leo. Cretaceous Flora. Report of the U. S. Geological Survey of the Territories. F. V. Hayden, U. S. Geologist, in charge. Vol. VI. Washington. F. V. Hayden.
Contributions to the Fossil Flora of the Western Territories. Part I. Cretaceous Flora. Department of Interior.
A Review of the Fossil Flora of North America. The Author.
Leuckart's Bericht, 1858–65. Rathmell Wilson.
Levaillant's Oiseaux d'Afrique. 4 vols. Folio. Rathmell Wilson.
Lewis, T. R., and D. D. Cunningham. A Report of Microscopical and Physiological Researches into the Nature of the Agent or Agents producing Cholera. Second Series. Calcutta. The Authors.
Lewis, T. R. The Pathological Significance of Nematode Hæmatozoa. Calcutta, 1874. The Author.
Lielegg, Andreas. Die Geologischen Verhältnisse Niederösterreichs. Wien, 1875. I. V. Williamson Fund.
Linder, M. O. Des Dépots lacustres du Vallon de Saucats. Bordeaux, 1872. The Author.
Lithograph of the Island of Julia, with description. Framed. Rev. Dr. Jas. Saul.
Lockyer, J. Norman. The Spectroscope and its Application. London, 1873. Purchased.
Lubbock, Sir John. On British Wild Flowers considered in relation to Insects. London. Purchased.
On the Origin and Metamorphosis of Insects. Purchased.
Ludlow, W. Report of a Reconnaissance of the Black Hills of Dakota, made in the summer of 1874. Washington, 1875. Engineer Dep., U. S. A.
Ludwig, Carl. Beitraege zur Anatomie und Physiologie als festgabe Carl Ludwig von Seinen Schuelern. 1er and 2er Heft. Leipzig, 1875. Wilson Fund.
Macedo, Joaquin Manoal de. Notions de Chorographie du Brésil. Traduction de J. F. Halbout. Leipzig. The Translator.
Malherbe's Monographie des Picides. 4 vols. Folio. Rathmell Wilson.
Mann, B. Pickman. Description of a Monstrous Female Imago of Anisopteryx pomentaria, with remarks on the pupa. The Author.
Explanation of the Corrigenda to a communication in these Proc., Vol. XV. Anisopteryx vernata, distinguished from A. pomentaria. The Author.
Marschall, Agusto de. Nomenclator Zoologicus. Vindobonæ, 1873. Purchased.
Marsh, O. C. New Order of Eocene Mammals, and Notice of New Tertiary Mammals. The Author.
On the Odontornithes, or Birds with Teeth. The Author.
McQuillen, Dr. J. H. A case of Oral Surgery. The Author.
Memoirs of John Lewis Russel and Henry Coit. Henry Wheatland.
Mémoires sur le Canada, depuis 1749 jusqu'a 1760. Quebec. The Author.
Menem's Beyträge zur besondern Geschichte der Vögel. 1er Heft. 1784. Rathmell Wilson.
Meinicke, Prof. Dr. Carl E. Die Inseln des Stillen Oceans. 1er Theil, Melanesien und Neuseeland. Leipzig, 1875. I. V. Williamson Fund.
Michaud's Complément des Mollusques de Draparnaud. Rathmell Wilson.
Middendorff, Dr. A. v. Siberische Reise. Band IV., Theil 2. 2e Lief. St. Petersburg. Imp. Acad. of St. Petersburg.

Milne Edwards, H. Leçons sur la Physiologie et l'Anatomie comparée de l'Homme et des Animaux. Tome 11me, 1re Partie. Paris. Wilson Fund.

H. and Alphonse. Recherches pour servir a l'Histoire naturelle des Mammifèrs. 2 vols. Paris, 1868–1874. I. V. Williamson Fund.

Mivart, St. G. Lessons in Elementary Anatomy. London. Purchased.

The Common Frog. London, 1874. Purchased.

Möhl, Prof. H. Mikromineralogische Mittheilungen. Die Basalte der Tauhen Alb. Stutgartt, 1874.

Der Scheidsberg bei Remagen am Rhein.

Die Basalte der Preussichen Oberlausitz.

Die südwestlichen Ausläufer des Vogelsgebirges.

Mikroscopische Untersuchung eineger Basalte Badens.

Ueber der Mineralogische Constitution und Eintheilung der Phonolithe.

Kleine Beiträge zum Vorkommen des Tridymets, Breislakits und Sodaliths.

Die Bühl bei Weimar in der Nähre von Kassel.

Zusammenstellung Mikrokopische Untersuchung und Beschreibung einer Sammlung typischer Basalte.

Die Nordlichsten Phonolithdurchbrüche der Rhön. 4to. Halle.

Die Basalte und Phonolithe Sachens.

Mikroskopisch Untersucht und Veschreiben. 4to. Dresden.

Mommsen's Griechische Jahreszeiten. Birds of Greece. Heft II. I. V. Williamson Fund.

Morelet, Arthur. Series Conchyliologiques. 4me Livr. Paris, 1875. Wilson Fund.

Moulins, Charles Des. Fragments Zoologiques. Nos. I.–IV. Bordeaux, 1872.

Notice Necrologique sur M. Élie Durand. Bordeaux, 1873. The Author.

Mudie, Robert. Domesticated Animals, popularly considered. Winchester. Purchased.

Müller, Wilhelm. Ueber das Urogenital system des Amphioxus und der Cyclostomen. Jena. Purchased.

Murie, James. On the Anatomy of a Fin Whale. Prof. Haldeman.

Murray, Andrew. The Geographical Distribution of Mammals. London. Purchased.

Nasmyth, James, and J. Carpenter. The Moon: considered as a planet, a world, and a satellite. 2d edition. London. Purchased.

Nehring, A. Fossile Lemminge und Arvicolen aus dem Diluviallehm von Thiede bei Wolfenbüttel. The Author.

Neumayer, Dr. G. Anleitung zu Wissenschaftlichen Beobachtungen auf Reisen. Berlin, 1875. Purchased.

Newberry, J. S. Report of the Geol. Surv. of Ohio. Vol. II. Geol. and Palæontology. Part I. Geology with maps. Columbus, 1874. J. S. Newberry.

Newton's Zoology. Manuals of Elementary Science, 1874. I. V. Williamson Fund.

Nüesch, Dr. J. Die Nekrobiose in Morphologischen Beziehung. Schaffhausen, 1855. I. V. Williamson Fund.

Nuhn, Dr. A. Lehrbuch der vergleichenden Anatomie. 1st Theil. Heidelberg, 1875. Wilson Fund.

Orsoni, Francesco. I Microfiti ed i Microzoi della chemica organica. 1875. The Author.

Owen. British Fossil Reptiles. Part VI. Rathmell Wilson.

Paetel, Fr. Die bisher veröffentlichen Familien und Gattungsnamen der Mollusken. Berlin, 1875. I. V. Williamson Fund.
Paleontologie Française, 25 duplicate numbers. Rathmell Wilson.
Same, 1e serie, Animaux Invert. Ter. Juras. Liv. 29 and 30, 2e. Vegetaux, Ter. Juras. Liv. 8 and 9. Wilson Fund.
Parker, W. K. On the Structure and Development of the Skull in the Pig (Sus scrofa.) The Author.
Parkinson's Organic Remains. 3 Vols. Rathmell Wilson.
Peabody, Alfred. Early Voyages to California. Henry Wheatland.
Pfeffer, Dr. W. Die Periodischen Bewegungen der Blatt-organe. Leipzig, 1875. Purchased.
Pfeiffer, Dr. Louis. Novitates conchologicæ. 46, 47, Lief. Cassel. Wilson Fund.
Monographia Heliceorum viventium. Vols. I.–IV. Mon. Pneumo napomorum viventium. 1 Vol. and Sup. 1 and 2. Vol. 7, Fasc. I., II. Lipsiæ. R. Wilson, and Williamson Fund.
Nomenclator botanicus. Conscripsit Ludovicus Pfeiffer. Vol. I. Fasc. 25, 27, 28, 29. Vol. II. Fasc. 25, 27. Cassellis, 1872. Vol. I. Fasc. 46. Vol. II. Fasc. 46. Purchased.
Philippi's Fauna Molluscorum Regni utriusque Siciliæ. Rathmell Wilson.
Phipson, Dr. T. L. The Utilization of Minute Life. London, 1864. I. V. Williamson Fund.
Photograph of Indian Skeletons exhumed at Marblehead, Nov. 10 and 11, 1874. Henry Wheatland.
Pinart, Alph. L. Voyages à la Côté Nord-Ouest de l'Amérique, exécutés durant les années 1870–72. Vol. I. Partie I. (Hist. Naturelle.) Paris, 1875. I. V. Williamson Fund.
Plancus' De Conchis Minus Notis, 1739. Rathmell Wilson.
Plateau, Felix. Notice sur Charles Poelman. Brussels, 1875. The Author.
Recherches sur les Phénomènes de la Digestion chez Insectes. Bruxelles, 1874. The Author.
Plues, Margaret. British Grasses. 1867. I. V. Williamson Fund.
Poey, Felipe. Poissons de l'Ile de Cuba. Especes Nouvelles. Salem. The Author.
Poggendorff's Biographisch-Literarisches Handwörterbuch. Lief 1–6. Rathmell Wilson.
Poro's Malacologia della Provencia Comasca. Rathmell Wilson.
Potiez and Michaud's Gallerie des Mollusques. Vols. 1 and 2, and Atlas. Rathmell Wilson.
Powell, M. Explorations of the Colorado River of the West and its tributaries, explored in 1869, 70, 71, and 72, under the direction of the Smithsonian Institution. Washington, 1875. Dep. of Interior.
Prestwich, Joseph. The Past and the Future of Geology. London, 1875. I. V. Williamson Fund.
Pringsheim, Dr. N. Jahrbucher für wissenschaftlichen Botanik. 10er Band, 1er Heft. Leipzig. 2er Heft. Purchased.
Proctor, Richard. Transits of Venus. New York. Purchased.
Proceedings at the Laying of the Corner Stone of the New Public Buildings on Penn Square. 1874. Building Commission.
Putnam, F. W. On some of the Habits of the Blind Crawfish, Cambarus pellucidus, and the reproduction of lost parts. The Author.
Archæological Researches in Kentucky and Indiana. 1874. The Author.
Puton's Mollusques des Vosges. Rathmell Wilson.
Rambosson, J. Astronomy. Translated by C. B. Pitman. New York. Purchased.

Rathke's Entwicklungsgeschichte der Wirbelthiere. Rathmell Wilson.
Ravenel, Catalogue of Recent and Fossil Shells in the Cabinet of the late Edmund Ravenel. The Author.
Reeve, Lovell. Conchologia Iconica. Parts 318–323. London. Wilson Fund.
Reclus, Elisée. The Earth. New York. Purchased.
The Ocean, Atmosphere and Life. 2 vols. London. Purchased.
Reichenbach's Icones avium. Rathmell Wilson.
Speciellen Ornithologie. 5 numbers. Rathmell Wilson.
Heinrich Gustav. Xenia Orchidacea. 2er Band, 9er Heft. 10er Heft, 1874. Purchased.
Repertorium der Naturwissenchaften. 1. Jahrg. Nos. 1–6, Jan.–Juni, 1875. The Editor.
Report of the Commission of Engineers appointed to investigate and report a permanent plan for the Reclamation of the Alluvial Basin of the Mississippi River subject to Inundation. Engineer Depart. U. S. A.
Upon the Invertebrate Fossils collected by the Expedition of 1871–2–3. With descriptions of new species. Engineer Department.
Upon the Ornithological specimens collected in the years 1871–2–3. Washington, Dept. of Interior.
Of the Committee appointed by the Board of Public Education to inquire into the sanitary condition of the Schools of the First District of Pennsylvania. Louis Wagner.
On the Meteorological, Magnetic, and other Observatories of the Dominion of Canada, 1875. Abstracts and Results from 1841–1871 inc. 2 vol. The Magnetic Observatory.
On the Niagara Falls Museum, with photograph of Mummies. Thos. Barnett.
Reuter, F. Observations Météorologiques faites à Luxembourg. Tome 2me. Institute Royal Grand-Ducal de Luxembourg.
Ribot, M. Heredity. From the French of Th. Ribot. New York. Purchased.
Ridgway, Robt. Birds of Colorado. Henry Wheatland.
List of Birds observed at various localities contiguous to the Central Pacific R. R. The Author.
Monograph of the Genus Leucosticte, Swns. or Gray-crowned Finches. Washington. The Author.
Outlines of a natural arrangement of the Falconidæ. Washington.
Monograph of the Genus Leucosticte or Gray-crowned Finches. Washington. Department of Interior.
Notes on the Bird Fauna of the Salt Lake Valley. Henry Wheatland.
Rodwell, G. F. The Birth of Chemistry. London. Purchased.
Rogers, 2d Annual Report on the Geology of Pennsylvania, 1838. Wilson Library.
Rothe, Prof. Dr. C. Die Säugethiere Niederösterreichs einschleisslich der fossilen Vorkomnisse. Wien, 1875. I. V. Williamson Fund.
Rousset. Observations on the Sea or Pile Worm. London. Prof. Haldeman.
Russ, Dr. Karl. Die fremländischen Stubenvögel ihre Naturgeschichte, Pflege und Zucht. 1e Lief. Hannover, 1875. Purchased.
Rütimeyer, L. Die Veränderungen der Thierwelt in der Schweiz. Basel, 1876. I. V. Williamson Fund.
Ruy, L. Das Pflanzenleben des Meeres. I. V. Williamson Fund.
Sachs, Julius. Text-book of Botany, Morphological and Physiological. Translated by Alfred W. Bennet and W. T. Thiselton Dyer. Oxford, 1875. I. V. Williamson Fund.

Samuelson, James. The Earth-worm and the common House-fly. London. Purchased.
The Honey Bee. London. Purchased.
Schliemann, Dr. Henry. Troy and its Remains. Edited by Philip Smith, B. A. London. Purchased.
Schimper, W. Ph. Traité de Paléontologie Végétale. 3 vols. 8vo., and Atlas folio. Purchased.
Schmarda's Geographische Verbreitung der Thiere, 1853. Imperfect. Rathmell Wilson.
Schlegel, H. Museum d'Histoire Naturelle des Pays Bas. 11e Livr. Leide. Wilson Fund.
Schmidt, Adolf. Diatomaceen. Berlin, 1874. Wilson Fund.
Schmidt, Dr. H. D. On the Development of the Smaller Bloodvessels in the Human Embryo. The Author.
Schmidt, Oscar. The Doctrine of Descent and Darwinism. New York. Purchased.
Schrauf, Dr. Albrecht. Atlas der Krystal-Formen des Mineralreiches. I.–IV. Lief. Wien, 1865–1873. I. V. Williamson Fund.
Schreiber, Dr. Egid. Herpetologie Europæa. Braunschweig, 1875. Purchased.
Scudder, S. H. Note on the Species of Glaucopsyche from Eastern N. America.
The two Principal Groups of Urbicolæ.
Note sur l'Œuf et le Jeune Age de la Chenille d'Oeneis Aello.
Facsimile reprint of Hübner's Tentamen Determinationis Digestionis atque denominationis singularum stirpium Lepidopterorum.
Notice of the Butterflies and Orthoptera collected by Mr. Geo. M. Dawson.
Entomological notes Nos. III. and IV.
Historical Sketch of the Generic Names proposed for Butterflies.
The Distribution of Insects in New Hampshire. Concord. The Author.
Seeley, Harry Govier. The Ornithosauria. Cambridge, 1870. I. V. Williamson Fund.
Seeman, Ezra C. Views of Nature. The Author.
Sellius' Historia Naturalis Terebinis, 1733. Rathmell Wilson.
Semper, Dr. C. Reisen im Archipel der Philippinen. 2er Theil, VIII. Heft. Purchased.
Sexe, S. A. Jaettegryder og gamle Strandlinier i fast Klippe. Christiania, 1874. Roy. Norway Acad. of Sci.
Sibbald's Scotia Illustrata. 1684. Rathmell Wilson.
Seidlitz, Dr. Geo. Die Darwin'sche Theorie. Leipzig, 1875. Purchased.
Sharpe, R. B. Catalogue of African Birds in the Collection of R. B. Sharpe. London, 1871. I. V. Williamson Fund.
Siebke, H. Enumeratio Insectorum Nowegicorum. Fasc. I. Christiania. Roy. Nov. Acad. of Sci.
Smith, George. Assyrian Discoveries; an Account of Explorations and Discoveries on the Site of Nineveh, during 1873 and 1874. New York. Purchased.
Smith, S. J., and O. Harger. Report on the Dredging in the Region of St. George's Banks, in 1872. The Author.
Solly, Samuel. The Human Brain. 2d ed. London, 1847. I. V. Williamson Fund.
Southall, James C. The Recent Origin of Man. Philadelphia. I. V. Williamson Fund.

Sowerby's Malacological and Conchological Magazine. Parts 1–2. London. Rathmell Wilson.

Sowerby, G. B. Thesaurus Conchyliorum. Parts 31 and 32. Mitra. Purchased.

Spinelli's Molluschi della Provincia Bresciana. 2d ed. Rathmell Wilson.

Spottiswoode, Wm. Polarization of Light. London. Purchased.

Stabile's Fauna Elvetica. Rathmell Wilson.

Stahlberger, E. Die Ebbe und Fluth in der Rhede von Fiume. Buda Pest. Hung. Nat. Hist. Soc.

Stein's Infusiensthiere. 1 Abth. Rathmell Wilson.

Stokley, W. S. 3d Annual Message of Wm. S. Stokley, Mayor of the City of Philadelphia, with accompanying documents. June 24, 1875. Philadelphia. From the City.

Sullivant, William S. Icones Muscorum. Supplement (Posthumous). Cambridge. Purchased.

Strecker, Herman. Lepidoptera, Rhopaloceres and Heteroceres. No. 12. Reading, Pa. The Author.

Strasburger, Dr. Edward. Ueber Zellbildung und Zelltheilung. Jena, 1875. I. V. Williamson Fund.

Sumichrast, Fr. Coup d'Œil sur la Distribution géographique des Reptiles au Mexique. The Author.

Theobald's Catalogue of Shells of Hindostan. Rathmell Wilson.

Thomson, J. The Straits of Malacca, Indo-China, and China. New York. Purchased.

Trafford, F. W. C. Amphiorama, ou la Vue du Monde des Montagnes de la Spezia. The Author.

Amphiorama, ou la Vue du Monde. 2e Notice. Zurich, 1875. The Author.

Tyndall, John. Sound. 3d edition.

Six Lectures on Light. Delivered in America in 1872–73. 2d edition. London. I. V. Williamson Fund.

Van Beneden and Gervais, MM. Osteographie des Cétacés vivants et fossiles. Text and plates. Liv. 12 and 13. Paris. Wilson Fund.

Van der Hoeven, J. Catalogue de la Celèbre Collection de Crânes provenant de Feu. Leiden, 1875.

Von Mohl, Hugo. Botanische Zeitung, herausgegeben von Hugo Von Mohl und D. F. L. Von Schlechtendal. 11er Jahrg. 1853. Berlin. Chas. F. Parker.

Van Vollenhoren S. C. Snellen, Pinacographie. I. S'Gravenhage, 1875. Wilson Fund.

Veslengius Joannés, De Plantes Agyptiis Patarii, 1638. S. S. Haldeman.

Villa's Dispositio Conchyliarum. Rathmell Wilson.

Waller, Horace. The Last Journals of David Livingstone in Central Africa. New York. Purchased.

Warren, G. K. An Essay concerning important physical features exhibited in the Valley of the Minnesota River and upon their significance. From the Engineer Department.

Preliminary Report of Explorations in Nebraska and Dakota, in the years 1855–56–57. Reprint. Washington, 1875. Engineer Department.

Wattel, C. R. De l'Utilité d'Introduire la Sériculture à la Nouvelle-Calédonie. The Author.

Wetherby, A. G. Description of Lepidopterous Larvæ. The Author.

Wheatley's Shells of the United States. Wilson Library.

Wheeler, Geo. M. Annual Report upon the Geographical Explorations and Survey west of the 100th Meridian in California, Nevada, Utah, Arizona, Colorado, New Mexico, Wyoming, and Montana. Department of Interior.

Preliminary Report upon Reconnoisance through Southern and Southwestern Nevada made in 1869, by First Lieut. G. M. Wheeler, assisted by First Lieut. D. W. Lockwood; under the orders of Brig. Gen. E. O. C. Ord. Washington, 1875. Eng. Department U. S. Army.

Progress Report upon the Geographical and Geological Explorations and Survey west of the 100th Meridian, in 1872. From the Engineer Department U. S. A.

Winchell, Alex. Michigan. Being condensed Popular Sketches of the Topography, Climate, and Geology of the State. With Charts.

Wolff, Dr. Julius. Untersuchungen über die Entwicklung des Knochengewebes. Leipzig, 1875. Purchased.

Wood, H. C., Jr. A Study of the Nature and Mechanism of Fever. The Author.

Zoologishe Ergebnisse der Nordseefahrt vom 21 Juli bis 9 Sept. 1812. Berlin, 1874. Wilson Fund.

JOURNALS AND PERIODICALS.

NORWAY.

Christiania. Det K. N. Frederiks Universitets Aarsberetning for Aaret. 1871–3.

Index Scholarum. 1874–5. Royal Norway Acad. of Science.

Forhandlinger i Videnskabs-Selskabet i Christiania. 1872–3. Royal Norway Acad. of Science.

Nyt Magazin for Naturvidenskaberne. 9e Binds, 3 and 4 Heft; 10e Binds, 1–4 Heft. Royal Norway Acad. of Science.

SWEDEN.

Stockholm. Meteorologisk Aarbog for 1870–73.

DENMARK.

Copenhagen. Mémoires de la Société Royale des Antiquaires du Norde. Nouvelle Série, 1873–74. Copenhagen. The Society.

Tillaeg til Aarboger for Nordisk Oldkyndighed og Historie. Aargang. 1873. The Society.

Oversigt over det K. D. Videnskabernes Selskabs Forhandlinger, 1874. No. 2. The Society.

RUSSIA.

Dorpat. Sitzungberichte der Dorpater Natursforscher-Gesellschaft. 3er Band, 5 and 6 Heft.

Archiv für die Naturkunde Liv-, Ehst- und Kurlands. 1e Série, 5er Band, 4e Lief, 7er Band, 2–4 Lief. 1874–5. The Society.

Helsingfors. Bidrag till Kanedom af Finlands Natur och Folk utgifna af Finska Vetenskaps-Societeten. Tjugondeforsta Hafte. The Society.

Observations faites à l'Observatoire Magnetique et Météorologique de Helsingfors. 5me vol. The Observatory.

Ofversigt af Finska Vetenskaps-Societetens Förhandlinger XIV., XV., XVI. The Society.

Moscow. Bulletin de la Société Impériale des Naturalistes de Moscou. Année 1873, No. 3; 1874, No. 4. The Society.

Nouveau Mémoires de la Société Impériale des Naturalistes de Moscou. Tome 13, Liv. IV., 1874. The Society.

St. Petersburgh. Horæ Societatis Entomologicæ Rossicæ. Vol. IX., Nos. 3, 4; Vol. X., Nos. 1–4. The Society.

Mémoire de l'Académie Impériale des Scienees de St. Petersburg. 7e Série, Tome 21, No. 6: Tome 22, No. 3.

Bulletin of the same. Tome 19, Nos. 4, 5; Tome 20, Nos. 1, 2. The Society.

HOLLAND.

Gravenhage. Tijdschrift der Nederlandsche Dierkundige Vereeniging. 1e Deel, Jahrg. 1874; 2e Afl. The Society.

GERMANY.

Berlin. Archiv für Naturgeschichte. Von F. H. Troschel. 38er Jahrg. 6e Heft. 40er Jahrg. 4es Heft. 41er Jahrg. 1es and 2es Heft. The Editor.

Same, 1864–5. Rathmell Wilson.

Deutsche Entomologische Zeitschrift, Herausg. von dem Entomol. Verein in Berlin. 19er Jahrg. 1es Heft. The Society.

Monatsbericht der K. P. Akademie der Wissenchaften zu Berlin vom Jahre 1859–1873; Sept., Oct., Nov., Dec., 1874. Jan., Feb., Marz, April, Mai, Juni, 1875. The Society.

Monatschrift des Vereins zur Beforderung des Gartenbaues, 17 Jahrg. The Society.

Sitzungberichte der Gesellschaft Naturforschender Freunde zu Berlin aus dem Jahre 1874. The Society.

Zeitschrift der Deutschen Geologischen Gesellschaft. 26 Band, 2, 3, and 4 Heft; 27 Band, 1 Heft. The Society.

Bonn. Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westphalens. 30 Jahrg. 3 Folge. 10 Jahrg. 31e Jahrg. 4e Folge. The Society.

Archiv für Mikroskopische Anatomie. 11er Band; 2es, 3es, 4es Heft. Bonn, 1875. Supplement Heft. Purchased.

Braunschweig. Archiv für Anthropologie. 7er Band, 3es Vierteljahrsheft, 8er Band, 2 Viert. Purchased.

Bremen. Abhandlungen Herausgegeben von Naturwissenschaftlichen Verein zu Bremen. 4 Bd., 2 und 3 Heft, 1874, 1875. Beilage, No. 4. The Society.

Brünn. Verhandlungen des Naturforschenden Vereins in Brünn. XII. Band. 1 und 2 Heft. The Society.

Buda Pest. Hungarian Natural Hist. Society. Termeszettudomanyi Közlöny. A. K. M. Termeszettadomanyi Tàrsulat. V. Kötet, Jan.–Dec. 1873. The Society.

Cassel. Malakozoologische Blätter. Bd. 22. Bg. 8–12. I. V. Williamson Fund.

Same, vols. 6–11. Rathmell Wilson.

Danzig. Schriften der Naturforschenden Gesellschaft in Danzig. Neue Folge, 3er Band, 3es Heft, 1874. The Society.

Darmstadt. Notizblatt des Vereins für Erdkunde. III. Folge, 13 Heft, 1874. The Society.

Dresden. Jahresbericht des Vereins für Erdkunde zu Dresden. Wissenschaftlichen Theil XI., XII. The Society.
Nova Acta Academiæ Cæsareæ Leopoldino Carolinæ Germanicæ Naturæ Curiosorum. Tome 36. Dresdæ, 1863. The Society.
Sitzungberichte der Naturwissenschaften Gesellschaft Isis in Dresden. Jahrg, 1874. Apr.-Sept., Oct., Dec. The Society.
Emden. 59er Jahresbericht der Naturforschenden Gesellschaft in Emden. The Society.
Erlangen. Sitzungsberichte der physikalisch-medicinischen Societät zu Erlangen. 6 Heft. The Society.
Frankfurt. Der Zoologische Garten. XV. No. 1–16. The Editor.
Jahrbücher der deutschen Malakozoologischen Gesellschaft. 2er Jahrg. Heft I. and II. The Society.
Freiburg. Berichte über die Verhandlungen der Naturforschenden Gesellscaft zu Freiburg, I. B. Band I., pp. 499 et seq. Band VI. Heft II., III. The Society.
Gera. 16er und 17er Jahresbericht der Gesellschaft von Freunden der Naturwissenschaften in Gera. 1873–74. The Society.
Göttingen. Nachrichten von der K. Gesellschaft der Wissenschaften und der Georg-Augusts Universität aus dem Jahre 1874. The Society.
Graz. Sitzungs-Berichte des Vereins der Aerzte in Steiermark. XI. Vereinsjahre 1873–4. The Society.
Halle. Abhandlungen der Naturforschenden Gesellschaft zu Halle. 13er Bandes, 2er Heft, 1874. The Society.
Bericht über die Sitzungen der Naturforschenden Gesellschaft zu Halle im Jahre 1874. The Society.
Hamburg. Abhandlungen aus dem Gebiete der Naturwissen herausgegeben von dem Naturwissenschaftlichen Verein in Hamburg. 5 Band, 4 Abth. 1873. 6 Band, 1 Abth. The Society.
Journal des Museum Godeffroy. Heft VI.–VIII. Purchased.
Verhandlungen des Vereins für Naturwissenschaftliche Unterhaltung zu Hamburg, 1871–74. The Society.
Hannover. Dreiundzwanzigster und 24er Jahresbericht der Naturhistorischen Gesellschaft zu Hannover für das Geschäftsjahr 1872–74. The Society.
Heidelberg. Verhandlungen des Naturhistorischen medecinischen Vereins zu Heidelberg. I.–IV. The Society.
Innsbruck. Zeitschrift des Ferdinandeum für Tirol und Vorarlberg. 3e Folge, 19er Heft, 1875. The Society.
Leipzig. Archiv für Anatomie, Physiologie und Wissenschaftliche Medecin. Jahrg. 1875. Heft II.–VI. I. V. Williamson Fund.
Journal für Ornithologie. 22 Jahrg. Heft III.; 23 Jahr. Heft I. Purchased.
Journal de Zoologie. 22 Jahrg. Heft IV. 4e Folge. 2 Band. Purchased.
Mittheilungen des Vereins für Erdkunde zu Leipzig, 1872–3. The Society.
Zeitschrift für Anatomie und Entwicklungsgeschichte. 1er Jahrg. 1 and 2 Heft. Purchased.
Zeitschrift für wissenschaftliche Zoologie. Band 13, 14, 15. Rathmell Wilson.
The same. 24es Band, 4es Heft. 26es Band, 1es Heft. I. V. Williamson Fund.
Luxembourg. Publications de l'Institut Royal Grand Ducal de Luxembourg. Tome XIV. The Society.

Marburg. Schriften der Gesellschaft zur Beförderung der gesammten Naturwissenschaften zu Marburg. Band 10. 5–10e Abth.
Sitzungsberichte of the same. The Society.
Neubrandenburg. Archiv des Vereins der Freunde de Naturgeschichte in Meklenburg. 1, 5, 7, 8, 11, 12, and 28 Jahrg. The Society.
Neustadt and Durkheim. Jahresbericht der Pollichia. 3, 4, 12, 14, 17, 22, 32. The Society.
Prague. Astronomische, Magnetische und Meteorologishe Beobachtungen an der K. K. Sternwarte zu Prag im Jahre 1874. 35 Jahrg.
Magnetische und Meteorologishe Beobachtungen an der K. K. Sternwarte zu Prag in Jahre 1873. The Observatory.
Sitzungberichte der K. B. Gesellschaft der Wissenschaften in Prag 1874.
Abhandlungen of the same. 1874. 6e Folge, 7er Band, 1875. The Society.
Regensburg. Correspondenz-Blatt des Zoologisch-Mineralogischen Vereins in Regensburg. 10, 11, 14, 27, and 28 Jahrg.
Abhandlungen of the same. 6, 7, 8 and 10 Heft 1856–75. The Society.
Flora, herausgegeben von der K. B. Botan. Gesellschaft in Regensburg. Neue Reihe. 32 Jahrg. The Society.
Schaffhausen. Verhandlungen der Schweizerischen Naturforschenden Gesellschaft in Schaffhausen am 18–20 Aug. 1873 56 Jahres versammlung. Jahresberichte 1872–73. The Society.
Stettin. Entomologische Zeitung. Herausgegeben von dem Entomologischen Vereine zu Stettin. 35er Jahrg. The Society.
Stuttgart. Neues Jahrbuch für Mineralogie, Geologie, und Palæontologie. Jahrg. 1874. 1–9 Heft, 1875. The Editor.
Württembergische naturwissenschaftliche Jahreshefte. 31 Jahrg. 1–3 Heft, 1875. The Society.
Wien. Denkschriften der K. Akademie die Wissenschaften. Mathem. Natur. Classe, 33er Band. The Society.
Sitzungsberichte der K. Akademie der Wissenschaften. Mathemat. Naturwissen. Classe. Band I and 2, und Band LXVIII., le Abth. III. 5. 2e Abth. III. 5. 3e Abth. I. 5. Band LXIX., le Abth. I.–IV. 2e Abth. I.–III. IV. Heft le Abth. to Band LXX. I. and II., Heft 3e Abth. The Society.
Jahrbuch der K. K. Geol. Reichsanstalt. Band 24, No. 4; Band 25, No. 3.
Verhandlungen of the same. 1–4, 6–10, 12, 13.
Abhandlungen of the same. Band VIII. Heft No. 1.
Wiesbaden. Jahrbucher des Nassauischen Vereins für Naturkunde. Jahrg. 27–28, 1873–74. The Society.
Würzburg. Arbeiten aus dem Zoologisch-Zootomischen Institut in Würzburg. Herausg. von Prof. Dr. Carl Semper. Nos. 1–6, and 2er Band, le Heft. 1872–74. I. V. Williamson Fund.
Verhandlungen der Physikal-medicin. Gesellschaft in Würzburg. Neue Folge, VIII. Band. 1–4 Heft. From the Society.
Würzburger Naturwissenschaftliche Zeitschrift. 3–6 Band. Rathmell Wilson.

SWITZERLAND.

Bern. Mittheilungen der Naturforschenden Gesellschaft in Bern aus dem Jahre 1873. No. 812–827. The Society.
Geneva. Effemeridi della Società di Letture e Conversazioné Scientifiche e d'altri Società educative. Nuova Serie, Disp. 6 and 7. Geneva, 1874. From the Society.

Mémoires de la Société de Physique et d'Histoire Naturelle de Genève. Tome 23, 2e Partie. 1873–74. The Society.

Lausanne. Bulletin de la Société Vaudoise des Sciences Naturelles. 2e Série. Vol. XIII. Nos. 73 and 74. The Society.

Zurich. Mémoires de la Societé Paléontologique Suisse. Vol. I. Purchased.

Vierteljahrsschrift der Naturforschenden Gesellschaft in Zurich. 18er Jahrg., 1–4es Heft. The Society.

BELGIUM.

Brussels. Mémoires Couronnés de l'Academie Royale des Sciences, Belles-Lettres et des Beaux Arts de Belgique. Collection in 4to. Vols. 15–22, 26, 37, 38.

The same. Collection in 8vo. Vols. 1–4, 7, and 23.

Mémoires de l'Académie Royale des Sciences, Belles-Lettres et des Beaux Arts de Belgique. Vols. 15–23, 28, 29. and 40. The Society.

Bulletin of the same. Vol. XVI., Pt. 1; XXI., Pt. 2; XXII.; 2d Series, Vols. 1, 2, 3, 35, 36, 37. The Society.

Annuaire, 1874. Bruxelles. The Society.

Society Entomologique de Belgique. Comptes Rendus. Serie II. Nos. 6–15. The Society.

Liege. Mémoires de la Société Royale des Sciences de Liege. Tome 14me and 2me Série, Tomes 4 and 5. The Society.

Mons. Mémoires et Publications de la Société des Sciences, des Arts et des Lettres du Hainaut. IIIe Série, Tome 9me. 1875. The Society.

FRANCE.

Angers. Mémoire de la Société Academique de Maine-et-Loire. Tome 27. Lettres et Arts. Tome 28. Sciences. The Society.

Mémoires de la Société Nationale d'Agriculture, Sciences et d'Arts d'Angers. Nouvelle Periode. Tome 17me. (1874.) Nos. 2, 3 and 4. The Society.

Auxerre. Bulletin de la Société des Sciences Historiques et Naturelles de l'Yonne, Année 1874. 28e Vol. The Society.

Besançon. Académie des Sciences, Belles-Lettres et Arts de Besançon. Séance publique du 25 Aout, 1873. The Society.

Bordeaux. Actes de la Société Linnéenne de Bordeaux. Tome 27, 2d Partie; Tome 28. 3me Série, Tome 8, 1re et 2me Partie. The Society.

Mémoires de la Société des Science Physiques et Naturelles de Bordeaux. Tome I., 2e Série, 1er Cahier; Tome X., 2e Cahier. The Society.

Société des Sciences Physiques et Naturelles de Bordeaux. Extrait des Procès-Verbaux des Séances. Tome X., pp. 9–19. The Society.

Lyons. Annales de la Société d'Agriculture, Histoire Naturelle et Arts Utiles de Lyon. 4me Série, Tome 4 and 5. With Folio Atlas. 2me Livr. de V. Thiolliere's Poissons Fossiles. From the Society.

Annales de la Société Linnéenne de Lyon. Tome 2me. Rathmell Wilson.

Annales des Sciences Physiques et Naturelles d'Agriculture et d'Industrie, publiée par la Société imperiale d'Agriculture, etc., de Lyon. 3me Série, Tome VIII. From the Society.

Mémoires de l'Academie des Sciences, Belles-Lettres et Arts de Lyon. Classe des Sciences. Tomes 6, 7, 15, and 20. Classe des Lettres. Tomes 5, 6, 7, 12, and 15. From the Society.

Metz. Mémoires de l'Académie de Metz. 3d Serie, 1e–2e Année. Tables Générales. 1819–1871. The Society.

Montpellier. Academie des Sciences et Lettres de Montpellier. Mémoires de la Section des Sciences. Tome VI., 2me Fasc. Année 1867. Tome VIII., 2e Fasc. Année 1872. Section de Médecine. Tome IV., 3–6 Fasc. The Society.

Orleans. Mémoires de la Société d'Agriculture, Sciences, Belles-Lettres et Arts d'Orleans. Tome XVI., No. 3. Tome XVII., Nos. 1, 2, 3. The Society.

Paris. Annales des Mines. 7me Série, 1re Livr. de 1875. Tome VII. Minister of Public Works, France.

Annales des Sciences Géologiques. Tome 6me, 1er Cahier.

Annales des Sciences Naturelles. 6me Série. Zoologie, Tome 1er, Nos. 1–4. 5me Série. Botanique, Tome XX., Nos. 3–6. 5me Série. Tome I., Nos. 1–6. Purchased.

Archives de Zoologie experimentale et générale. Tome 3me, Nos. 3 and 4. Tome 4me, Nos. 1 and 2. Purchased.

Bulletin de la Société Botanique de France. Tome 20me, Session Ex. 1. Tome 21me. Revue Bibliographique, C., D., and F. Comptes Rendus des Sciences, 3. Tome 22me, 1875. Revue Bibl., A. The Society.

Bulletin Mensuel de la Société d'Acclimatation. Tome 2. Tome 9, No. 2; 3me Serie, Tome 2, No. 9. The Society.

Journal de Conchyliologie. 3e Serie. Tome XIV., No. 4. Tome XV., Nos. 1, 2, and 3.

Same, 1863–64–65. Rathmell Wilson. The Editor.

Journal de Zoologie. Par M. Paul Gervais. Tome III., No. 6. Tome IV., Nos. 1, 2, 3, and 4.

Revue Scientifique de la France et de l'Étranger. 4me Année, No. 24. to 5me Année, No. 19. The Editor.

Revue and Magasin de Zoologie, 1865. Nos. 8–11. Rathmell Wilson.

Toulouse. Mémoires de l'Académie des Sciences, Inscriptions et Belles Lettres de Toulouse. 7me Série. Tome VI. The Society.

ITALY.

Milan. Programma del R. Instituto technico Superiore in Milano per l'Anno Scolastico 1874–75. Publicato per cura del Consiglio direttivo. The Society.

Modena. Annuario della Società dei Naturalisti in Modena. Serie IIa Anno IX. Fasc. 1 and 2. The Society.

Naples. Atti del Reale Instituto d'Incorraggiamento alle Scienze Naturali di Napoli. 2d Serie. Tome X. and XI. 1875. The Society.

Torino. Atti della R. Academia delle Scienze di Torino. Vol. IX. Nos. 1–5. The Society.

Trieste. Bollettino della Società Adriatica di Scienze Naturali in Trieste. No. 1. 1874. The Society.

GREAT BRITAIN.

Belfast. Annual Report of the Proceedings of the Belfast Naturalists' Field Club, 1873–74. Series II., Vol. I., Pt. I., 1875. The Society.

Dublin. Journal of the Royal Dublin Society. Vol. II., III., and No. 25. The Society.

Journal of the Royal Geographical Society of Ireland. Vol. II., Parts 1, 2, 3. Vol. III., Part 2. The Society.

Journal of the Royal Geological Society of Ireland. Vol. XIV., Part I. The Society.

Edinburgh. Proceedings of the Royal Society of Edinburgh. Session 1873–4. No. 87.

Transactions of the same. Vol. 27, Part II. The Society.

Transactions and Proceedings of the Botanical Society of Edinburgh. Vol. XII., Part I. The Society.

Transactions of the Botanical Society. Vol. VII., Parts 1, 2. Vol. IX., Part 2. The Society.

Glasgow. Proceedings of the Philosophical Society of Glasgow, 1874–75. Vol. IX., No. 2.

Transactions of the Geological Society of Glasgow. Vol. I., Parts 1. Vol. III., Parts 1, 2, and Supplement, Vol. IV., Parts 1, 2, 3, Vol. V., Part 1. The Society.

Liverpool. Proceedings of the Literary and Philosophical Society of Liverpool, No. 28. The Society.

London. Curtis's Botanical Magazine. Vols. I.—100, 1790–1874. I. V. Williamson Fund.

Gervillea. A Monthly Record of Cryptogamic Botany and its Literature. Edited by M. C. Cooke. Vol. I. 1872–3. The Editor.

Hardwicke's Science Gossip. 1866–1875. Sept. and Oct., 1875. I. V. Williamson Fund.

Journal of Botany, British and Foreign, Nos. 145–154. I. V. Williamson Fund.

Journal of the Chemical Society. Aug.–Dec. 1874. Jan.–July, 1875. From the Society.

Linnean Society, Proceedings of. The Sessions of 1873–4., Additions to the Library, etc. Journal: Botany, Vol. 14, Nos. 77–8; Zoology, Vol. 12, Nos. 58 and 59. The Society.

Nature. Nos. 158–315 inclusive. Chas. F. Parker and The Editor.

Notes and Queries. Parts XII.–XVII., 5th Series. The Editor.

Proceedings of the Royal Geographical Society. Vol. XVIII., No. 1. Vol. XIX., Nos. 1–7.

Proceedings of the Zoological Society of London, 1874, Part IV.; 1875, Part I.; 1871, Part I.

Transactions of the same. Vol. VII., Parts 7 and 8; Vol. VIII., 1 and 2; Vol. IX., 1–3. The Society.

Quarterly Journal of Microscopical Science, N. S., Nos. 2–15 and 32–60. Purchased.

Report of the Proceedings at the Dinner of the Cobden Cub. July 11, 1874. The Club.

Report of the 43d Meeting of the British Association for the Advancement of Science, held at Bradford, Sept. 1873.

Same. 44th Meeting, 1874.

The Annals and Magazine of Natural History, Nos. 75–79, and 85–93, 4th series. Purchased.

The Ibis. 3d series, Nos. 16–19. Vol. V., 17, 18, 19. Vol. III., Supplement, 1873. Purchased.

The Journal of Anatomy and Physiology, conducted by G. M. Humphrey and Wm. Turner. 2d Series, Nos. XIV.–XVI.

The Journal of the Royal Asiatic Society of Great Britain and Ireland. New Series, Vol. VII., Part II., and 52d Annual Report. The Society.

The Journal of the Linnean Society. Vol. XIV., Nos. 73–75, Botany; Vol. XII., No. 57, Zoology.

The Journal of the Royal Horticultural Society of London. Vol. IV., new series, Part 15. The Society.
The Journal of the Society of Arts. Vol. 22. The Society.
The Gardener's Chronicle. Nos. 57 and 71–97. The Editor.
The Geological Magazine. Nos. 127–136. I. V. Williamson Fund.
The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science. 4th Series, Nos. 311–315, and 321–332. Purchased.
The Micrographic Dictionary. 3d ed., Vols. I. and II. Purchased.
The Monthly Microscopical Journal. Nos. 37–60, 73–83. Purchased.
The Popular Science Review. Vol. V. and Vols. VIII.–XIV. I. V. Williamson Fund.
The Zoological Record for 1873. Wilson Fund.
Transactions of Linnean Society. Vol. XXVIII., Part 4; Vol. XXIX., Part 3; Vol. XXX., Parts 1, 2, 3. Second Series. Botany, Vol. I., Part 1. Zoology, Vol. I., Part 1. The Society.
Trübner's American and Oriental Literary Record. Nos. 106–107. The Publishers.
Newcastle-upon-Tyne. Natural History Transactions of Northumberland and Durham. Vol. VI. The Society.
Watford. Transactions of the Watford Natural History Society. Vol. I., Pt. 1., 1875. The Society.

UNITED STATES.

Albany. 21st and 22d Annual Report of the Regents of the University of the State of New York, on the Condition of the State Cabinet of Natural History, 1869–72. The Regents.
Buffalo. Bulletin of the Buffalo Society of Natural Sciences. Vol. II. No. 4; Vol. III., No. 1. The Society.
Boston. Proceedings of the American Academy of Arts and Sciences. New series. Vol. II. The Society.
Proceedings of the Boston Society of Natural History. Vol. 17, No. 2. Vol. 18, No. 1. The Society.
Memoirs of the same. Vol. 2, Part 3, No. 5; Part 4, Nos. 1–3. The Society.
Cambridge. Annual Report of the Museum of Comparative Zoology, 1874. The Directors.
Eighth Annual Report of the Trustees of the Peabody Museum of American Archæology and Ethnology, 1875. The Trustees.
Hartford. Proceedings of the Am. Association for the Advancement of Science, 23d meeting, held at Hartford, Conn., Aug. 1874. The Society.
New Haven. American Journal of Science and Arts. 3d Series. Vol. LIX., Nos. 49–59. The Editors.
New York. The American Chemist. Vol. V., No. 6–Vol. VI., No. 3. The Editor.
Annals of the Lyceum of Natural History of New York. Vol. XI., Nos. 1–6. The Society.
Bulletin of the Torrey Botanical Club. Vol. 5, Nos. 7, 10, and 12; Vol. VI., Nos 1, 4, 5, and 9. Thos. Meehan.
Journal of the American Geographical Society of New York. Vol. IV. The Society.
New York Medical Journal. Vol. XXI.–Vol. XXII., 5. The Editor.
Popular Science Monthly. No. 34–44. The Editor.
Transactions of the New York Academy of Medicine. 2d Series, Vol. I.
Proceedings of the same. May 20, 1875.

Philadelphia. American Journal of Conchology. Vol. 1, Parts 1–4. Rathmell Wilson.

American Journal of Pharmacy. 4th Series, Nos. 1–10. The Editor.

Annual Report (3d) of the Board of Managers of the Zoological Society of Philadelphia. The Society.

Eighth Annual Report of the Board of Trustees of the Building Fund of the Academy of Natural Sciences of Philadelphia. From the Board.

Proceedings of the Academy of Natural Sciences of Philadelphia. Parts 1 and 2. 1875. The Publication Committee.

Proceedings of the American Pharmaceutical Association at the 22d Annual Meeting, held in Louisville, Ky., Sept. 1874. The Society.

Proceedings of the American Philosophical Society. Vol. XIV., Nos. 91–94. The Society.

Transactions of the same. Vol. XV., New Series, Part II. The Society.

The American Journal of the Medical Sciences. Nos. 137–140.

The Medical News and Library. Vol. 32, Nos. 385–395. The Editor.

The Dental Cosmos. Vol. 17, Nos. 1–11. The Editor.

The Gardener's Monthly. Vol. 17, Nos 1–11. The Editor.

The Journal of the Franklin Institute. 3d Series, May, 1875. Vol. 69, Nos. 1, 3, and 5; 589–593; The Editor.

The Penn Monthly. Nos. 63–71. The Editor.

Salem. Bulletin of the Essex Institute. Vol. 6, No. 9; Vol. 7, No. 5. The Society.

Proceedings of the 23d Anniversary of the Essex Institute, March 5, 1873. Henry Wheatland.

The American Naturalist. Vol. 9, Nos. 1–11. Editor.

St. Louis. The Transactions of the Academy of Science of St. Louis. Vol. III., No. 2. The Society.

The Western. New Series. Vol. 1, Nos. 1–11. The Editor.

Washington. Annual Report of the Chief of Engineers to the Secretary of War for the year 1874. In two parts. The Author.

Bulletin of the U. S. Geol. and Geog. Survey of the Territories. Nos. 2 and 3. Second Series. Dept. of Interior.

Circular No. 8, War Department, Surgeon-General's Office. A Report on the Hygiene of the U. S. Army, with descriptions of Military Posts. War Department.

1st, 2d, and 3d Annual Reports of the U. S. Geological Survey of the Territories for the years 1867–68–69.

Supplement to 5th Annual Report of ditto.

Miscellaneous Pub. No. 1, Gannett's List of Elevations.

Catalogue of Photographs.

Field and Forest. Vol. 1, Nos. 1 and 2. The Editor.

Monthly Report of the Bureau of Statistics, Treasury Department. The Department.

Report of the Commissioner of Education. The Author.

Smithsonian Reports for 1873–74. The Institution.

Worcester. Proceedings of the American Antiquarian Society. Nos. 63–64. 1875. The Society.

CANADA.

London. The Canadian Entomologist. Vol. 6, No. 11; Vol. 7, No. 10. The Editor.

Ontario. Report of the Entomological Society of the Province of Ontario for the year 1874. The Society.

Quebec. Le Naturaliste Canadien. Vol. VI., No. 12–Vol. VII., No. 10. Editor.

Toronto. The Canadian Journal of Science, Literature, and History. Vol. XIV., No. 4. The Editor.

MEXICO.

Mexico. Boletin de la Sociedad de Geografia y Estadistica de la Republica Mexicana. Tercera Epoca. Tome II., Nos. 1–4. Mexico, 1875. The Society.

El Propagandor Industrial. Tome I, Nos. 4 and 6. Mexico, 1875. The Editor.

La Naturaleza. Tome III., Nos. 7–16. Mexico, 1875. The Mex. Soc. of Nat. Hist.

SOUTH AMERICA.

Buenos Ayres. Anales del Museo Publico de Buenos Ayres. Entrega 1, 3–11. Director of the Museum.

ASIA.

Batavia. Tijdschrift voor Indische Taal-Land-en Volkenkunde, uitgegeven door het Bataviaasch Genootschap van Kunsten en Wetenschappen. Deel XX., Afl. 4–6. Deel XXI., Afl. 1 and 2.

Notulen of same. Deel X., No. 4. Deel XI., Nos. 1–4. 1873.

Alphabetical Lists, etc., 1873. The Society.

Calcutta. Journal of the Asiatic Society of Bengal. Part I., Nos. 1, 3, and 4. Part II., Nos. 2, 3, and 4. 1875.

Proceedings of same. Nos. 8, 9, 10. 1875. Isaac Lea.

Records of the Geological Survey of India. Vol. VII.

Memoirs of same. 8vo. Vol., X., Part 2; Vol XI., Part I.

Memoirs of same. 4to. Palæontologia Indica. Ser. X., 1. The Survey.

Yokohama. Transactions of the Asiatic Society of Japàn. Vol. 3, Part 1. The Society.

NEW ZEALAND.

Wellington. Transactions and Proceedings of the New Zealand Institute, 1874. Vol. VII. The Society.

Tasmania. Monthly Notices of Papers, and Proceedings of the Royal Society of Tasmania for 1873. The Society.

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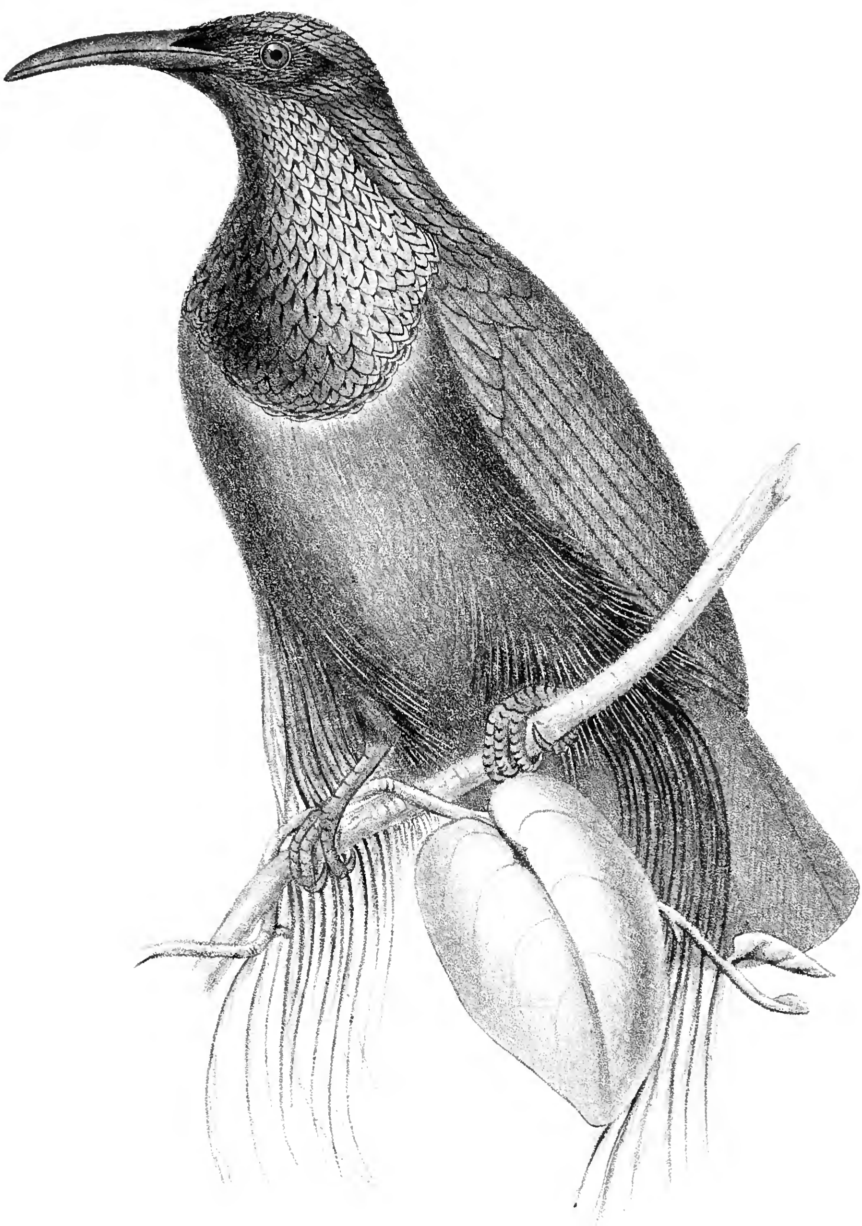

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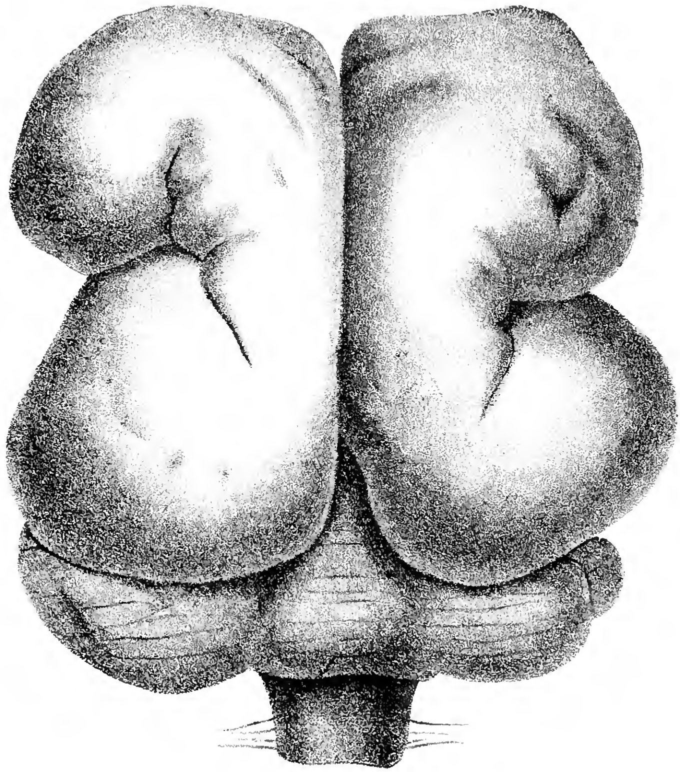

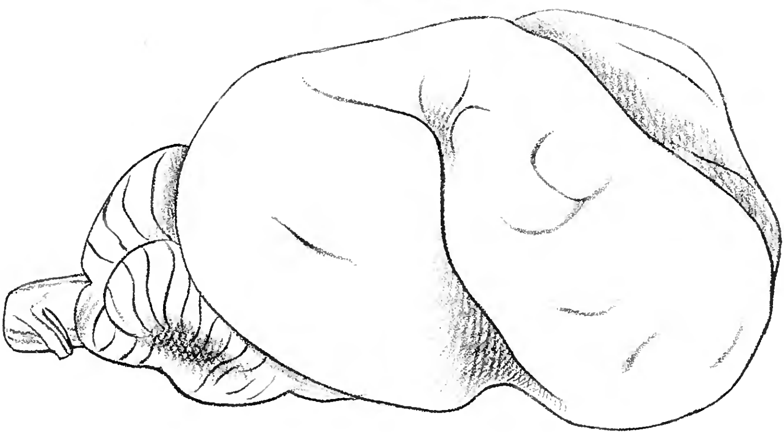

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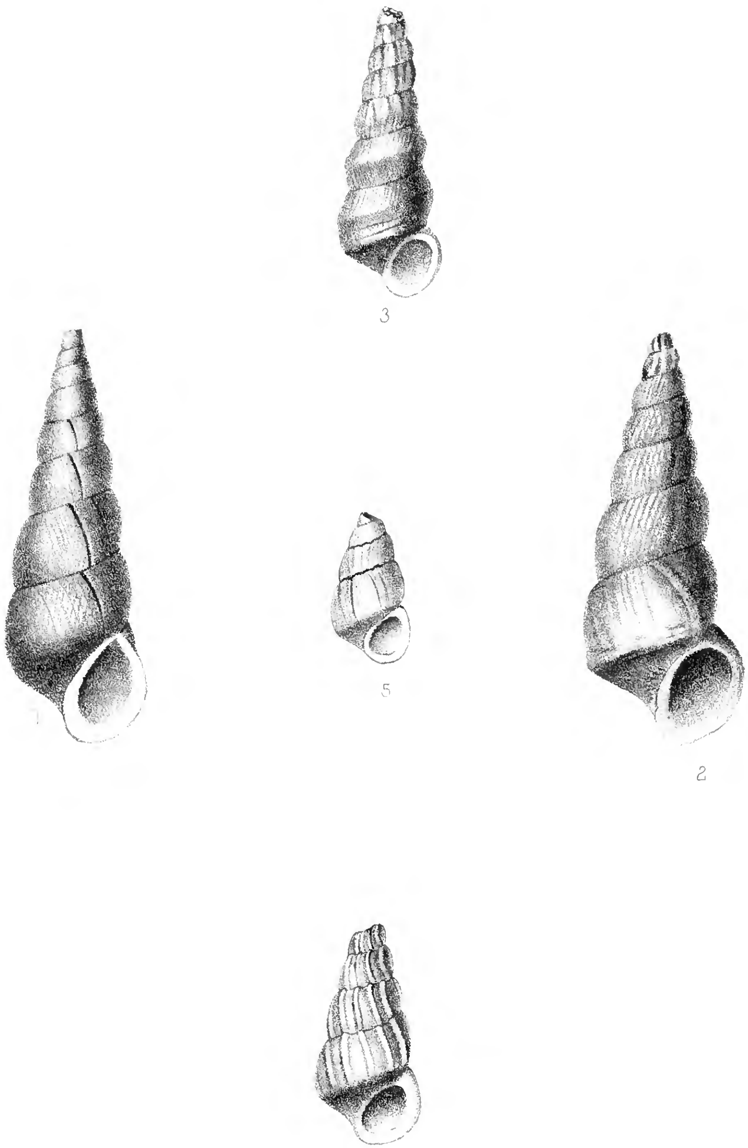

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OF THE

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OF

PHILADELPHIA.

PART I.—January, February, March, April, 1875.

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1875.

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February, 1875.

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