PROCEEDINGS

OF THE

ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

1868.

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LIST OF CONTRIBUTORS,

With references to the several Articles contributed by each.

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Jan. 7th, 1868.

The President, Dr. Hays, in the Chair.

Thirty-three members present.

The following papers were presented for publication:

"Description of some extinct fishes, previously unknown." By E. D. Cope.

"Monograph of the Alcidæ." By Elliott Coues, M. D., U. S. A.

Jan. 14th.

Mr. Vaux, Vice-President, in the Chair.

Twenty-six members present.

The death of Edward B. Grubb, of Burlington, N. J., a member of the Academy, was announced.

On leave being granted, the Committees on the following papers reported in favor of their publication in the Proceedings:

"On the habits of a Tipulideous Larva." By E. D. Cope.

"Mechanical theory of Solar Heat." By Jacob Ennis.

"Description of five new species of Central American Birds." By Geo. N. Lawrence.

On motion, it was resolved that these papers should be printed in the Proceedings for December, 1867.

Jan. 21st.

Mr. Cassin, Vice-President, in the Chair.

Twenty-three members present.

The following paper was presented for publication:

"List of birds collected in Southern Arizona by Dr. E. Palmer, with remarks by Dr. Elliott Coues, U.S.A."

E. D. Cope made some observations on some specimens of Vertebrata presented by Wm. M. Gabb, of San Francisco, which were procured by him in western Nevada and the northern part of Lower California.

Of reptiles were two undescribed species of Boas, thus increasing the species of the Fauna Nearctica to four, all of which belong to the family Lichanuridæ Cope. The new species belong to Lichanura Cope, and are thus characterized: L. roseofusca; scales in 36 series, those in the orbital ring seven or eight, the anterior fused into a large preocular. Loreals $\frac{3}{1}$ Color brown above. Belly and especially gular region pink shaded. Length two feet five inches. L. myriolepis; scales in 45 rows, those in the orbital ring of equal size, ten in number; loreals $\frac{3}{3}$. Color leaden blue, with three rusty red bands extending throughout the length, but very indistinct on the anterior half of the body.

Of mammalia he noticed a good specimen of the Lagomys princeps, from an elevation of 10,000 feet on the Sierra Nevada, near lat. 32°, a locality about 10° further south for the genus than had been hitherto recorded for this continent. Another interesting species was an Arvicola, allied to the A. modesta of Baird, but not described, from Pigeon Springs, on the eastern boundary line of California, east of Owen's Valley. The characters are as follows: Arvicola curtata Cope; one of the smallest species of the genus, differing from A. modesta in its much shorter hind foot and tail, in the lower anterior molar with two external triangles instead of three, in the very light color, and other points. Ears well developed, the marginal half loosely furred externally; long silky hairs from the meatus within, on the exterior two-thirds. Anterior lower molar with a posterior triangle, three internal and two external triangles, with an open trefoil. Tail vertebræ a little shorter than the hind foot, and about one-half the head. Hind foot a little over half the head, and five thirds the length of the fore foot. Some long hairs at the bases of the toes, posterior half of the sole densely hairy. Hair on upper surface of feet very long, concealing the claws. Fur rather long, dense, base dark leaden, followed by a light grey, and light brown tip on the upper parts of head and body; general resulting color above light greyish brown; below and feet white.

		In.	Lin.
Length	to end tail vertebræ	2	9·4
"	head, (slightly crushed)		10·7
"	tail vertebræ		4·8
"	ear from meatus		2·
"	fore foot		3·8
"	hind foot		6·
"	whiskers		10·8

On favorable reports of the Committees, the following papers were ordered to be published:

A Monograph of the ALCIDÆ.

BY ELLIOTT COUES, A.M., M.D.

Assistant Surgeon United States Army.

"Hinc bonus Moehringivs, boni Brissonivs, Kleinivs, Linnaé cet. sed in medio in omnes veritas et Naturæ ordo!"—*Pallas.*

The *Alcidæ* contained in the collections of the Smithsonian Institution, Washington; the Academy of Natural Sciences, Philadelphia; the Society of Natural History, Boston; the Essex Institute, Salem; and in the private cabinet of Mr. Geo. N. Lawrence, of New York, have been examined in the preparation of the present memoir. The writer tenders his acknowledgements to the officers having immediate charge of these collections, for numerous favors shown him, in a variety of ways, during the prosecution of his researches.

Nearly all the known species of the family are represented in the several collections above named; and the libraries of these Institutions contain all needed works of reference. Being based upon such ample data, this monograph ought to embody all that is known of the *Alcidæ* in a technical point of view, and constitute a fair exponent of the same. The writer ventures to indulge the hope that it may not be found to fall far short of this standard.

Before proceeding to the proper matter of the subject, it may be well to glance at what has already been done in this family of birds. Following is a list, in chronological order, of the principal works in which *Alcidæ* are made more or less of a specialty, with remarks upon each. It is obviously by no means a bibliography of the family; only those works being noticed in which some special point is presented. It may pass, however, for a reviewing sketch of the literature of the subject, and as such may be valuable and helpful to the student. Consultation of most of the works mentioned below is absolutely necessary to a correct understanding of the subject, except in so far as it may be obviated by perusal of the text of the present paper.

I. *Review of the Literature of the Family.*

Certain species of *Alcidæ* made their appearance in the very earliest ornithological writings of which we have any knowledge, long before the establishment of the science upon any fixed and recognized basis. However desirable it may be—as well in justice to early authors, as tending to bring the whole subject in the strongest light—to collate and identify, as far as possible, the older names of these species, the attempt to cite as authoritative names and descriptions which antedate the foundation of the binomial system of nomenclature would be at once embarrassing and profitless. There must be a fixed initial point for the commencement of authority in the matter of names in the existing system of zoological nomenclature; otherwise a writer might adopt names at pure caprice; in which event the species he treats of would be recognizable only by synonymy adduced, or descriptions appended, and names would fail of their proper purpose by becoming simply indices of the extent of his philological research. The date of the tenth edition of the Systema Naturæ furnishes an unobjectionable starting-point, beyond which investigation need only extend from motives of curiosity; and is on several accounts more eligible than the date of the twelfth edition.

Mœhring, a mononomial author whose work appeared in 1752, has very frequently been quoted as authoritative, notably, among European authors, by Gray, and among American by Cassin, Baird, Bryant and others, including the present writer. Five genera of *Alcidæ* are instituted in this work of Mœhring's: (1) *Chenalopex*, based on *Alca impennis;* (2) *Spheniscus*, upon *Fratercula arctica;* (3) *Arctica*, upon *Mergulus alle;* (4) *Vria* (sc. *Uria*), upon *U. grylle;* and (5) *Cataractes*, upon *Lomvia troile*. Of these five, *Arctica* and *Cataractes* have never come into use, except in an isolated instance or two; *Uria* is in universal employ, accredited, however, as it should be, to a later writer; *Spheniscus* is used, in an entirely different acceptation, for a genus of Penguins; and *Chenalopex* for an Anserine genus. These names, though all positively identified, will not be countenanced in their Mœhringian acceptation, for reasons just mentioned.

(1758.) LINNÆUS, *Syst. Nat., ed.* x.—The Linnæan genus *Alca* at this date comprehended six species, to wit: *impennis, torda,* "pica," *arctica, lomvia, alle.* Two Guillemots—*grylle* and *troile*—are presented under the genus *Colymbus.* Excluding from these eight species *Alca* "pica," which is the winter plumage of *torda*, we have at the outset of authoritative records seven Linnæan names, for as many valid species, representing as many distinct genera. The twelfth edition (of 1766) gives us nothing new.

(1760.) BRISSON, *Ornithologia.*—This author gives excellent descriptions of the then known species, but adds no new valid ones, though several stages of plumage are characterized under distinctive names. He was a polynomialist —to our lasting regret, and his great misfortune—and therefore not authoritative in the matter of species. With those, however, who quote him for genera, his *Fratercula* will stand as the name of the genus of which *Alca arctica* Linn. is the type; and his *Uria* for that one typified by *Uria grylle.*

(1764.) BRUNNICH, *Ornithologia Borealis.*—This author was a strict binomialist; the question of the adoption of his names only hinges upon the acceptation of Linnæus at 1758 or at 1766. Brünnich's names are in general employ, as they should be. The chief point of this work, regarding the Auks, is the characterization of *Uria ringvia*, which, though known long before, had been usually referred to *troile.* Brünnich describes the young or winter plumage of *Utamania torda* under the names "unisulcata" and "balthica;" the young *Fratercula arctica* as "Alca deleta;" the albino *Mergulus alle* as "Alca candida;" various plumages of *Uria grylle* as "grylloides," "balthica," and —— (No. 116). Brünnich's "Uria lomvia" is *Colymbus troille* Linn.; his "Uria troille" and "Uria svarbag" are both *Alca lomvia* Linn.; his "Uria alga" is *ringvia* Brünn. in winter plumage. His descriptions, though brief, are all recognizable. (Species now eight.)

(1769.) PALLAS, *Spicilegia Zoologica, fasc.* V.—Among the writers of the 18th century, no one contributed so much to a knowledge of the *Alcidæ* as Dr. Pallas. He introduced more new valid species than any other writer, and gave us our first knowledge of some of the curious forms from the North Pacific. His works claim the high eulogium, that every one of the species they contain are identifiable from the descriptions, and that a species is very rarely twice described as new. In the Spicilegia four species are for the first time described: *Alca cirrhata, A. psittacula, A. cristatella* and *A. tetracula.* A white state of plumage of *Uria grylle* (or possibly of *U. columba*) is described as "Cephus lacteolus." The four species above mentioned are well described, and illustrated by plates. (Species now twelve.)

(1785.) PENNANT, *Arctic Zoology.*—Although the author used only vernacular names, his work must be here considered, since in it four species are for the first time presented. These are the "Antient Auk" (for which the author is indebted to Dr. Pallas' MS.), the "Labrador Auk," the "Pigmy Auk," and the "Marbled Guillemot." The second and third of these are very dubious species, which have never been located to the entire satisfaction of ornithologists (cf. infrà, under head of *Fratercula arctica* and *Simorhynchus pusillus*); the first and fourth are good species. In this work the future *Uria columba* is hinted at, but not named. (Species now fourteen.)

(1788.) GMELIN, *Systema Naturæ.*—In this compilation by the professional plagiarist nothing new is given, but some points require notice. The genera *Alca* and *Colymbus* retain, in general, their Linnæan signification. Pennant's four species, above noticed, appear in proper Latin garb, as *Alca antiqua, A. labradorica, A. pygmæa* and *Colymbus marmoratus;* Pallas' four species are continued. "Cepphus lacteolus" Pallas re-appears as "Colymbus lacteolus." Linnæus' "Colymbus" *troille* is repeated, of course; but the other two species of Murre, though having already made their débût, are discontinued, unless one of them is intended by a certain "Colymbus minor" Gm., for which Brünnich's Nos. 110, 111, are cited. *Alca* "pica" and *A.* "balthica" are perpetuated. (No additions; species still fourteen.)

(1790.) LATHAM, *Index Ornithologicus.*—This is the one of Dr. Latham's several works in which species are binomialized, and it is therefore the authoritative one. Except in adopting *Uria* (after Brisson), the Index is nearly a repetition of Gmelin. We have nothing new, except the first unequivocal indication of *Uria columba* in Latham's "*Uria grylle* Var. B, from Aoonalaschka" ("fascia alarum gemina alba," which was "grylle Var. A" of Latham's Synopsis, vol. iii.) "Alca candida" Brünn. and "Cepphus lacteolus" Pallas—both of which are merely albinos—still hold their ground; but the nominal species based upon the plumages of *Utamania torda*, hitherto rampant, subside into "varieties." (Species still fourteen.)

(1790.) Bonnaterre, *Encyclopedie Methodique, Orn.*—Genus *Pinguinus* instituted, with *Alca impennis* L. as type. A certain "Uria nivea" is named, for which the author quotes Pallas, Spec. Zool. v. p. 33 ("lacteolus"; = albino *grylle* or *columba*).

(1794.) Donndorff (Johann August), *Beyträge Zoologische*, zweyter band, erster theil.—The great synonymist of the eighteenth century, as he fairly deserves to be called, gives no descriptions, but laboriously collates astonishing lists of synonyms. In the cases of some well-known birds, the citations stretch over several pages, giving one such an idea of the extent of the ornithological literature of the last century as could hardly be gained from any other work. Donndorff follows Linnæus in his reference of the Auks to two genera, *Alca* and *Colymbus;* the now sub-family *Urinæ* composing his "Colymbi mit dreyzehigen Füssen," as distinguished from the four-toed Divers proper. With this author *Alca* "pica" and "balthica" revive; *A.* "labradorica" and *A.* "pygmæa" continue in their original significance; Pallas' four species remain, and also his nominal species "lacteolus;" five varieties of *grylle* are enumerated, of which Var. "B" is *columba*. By the names "Colymbus minor" and "troile" the author probably intends to distinguish two species of Murre, but his synonyms are inextricably confused. The var. "γ" of *troile* is, however, unmistakeably *r ngvia* of Brünn.

Such was the general status of Alcidine literature as it came from the hands of the writers of the eighteenth century. We have fourteen well-known valid species, and indications of the fifteenth (*Uria columba*).

(1801.) Lepechin, *Nova Acta Petrop.* xii.—*Alca camtschatica* described. (Species now fifteen.)

(1811.) Pallas, *Zoographia Rosso-Asiatica*.—Dr. Pallas for the second time comes forward to take a long step in advance of his contemporaries, with numerous new species from the North Pacific, and with a more extensive subdivision of the family. Six valid new species are described: to wit, "Cepphus" *columba*, "Cepphus" *carbo*, "Alca" *monocerata*, "Uria" *aleutica*, "Uria" *dubia*, and "Uria" *pusilla*. Four known species are re-named: the Antient Auk being called "Uria senicula," the Camtschatkan Auk "Uria mystacea," the thick-billed Guillemot "Cepphus arra," and the marbled Guillemot "Cepphus perdix." "Cepphus lomvia," Pallas, equals "Uria lomvia," Brünnich, equals "Colymbus" *troile*, Linnæus. As in 1769, Dr. Pallas calls the Guillemots all "Cepphus;" all the other Auks are consigned to "Uria" except the Puffins, for which the generic name "Lunda" (after Gesner) is employed. *Alca psittacula* is ranged in this genus. (Species now twenty-one.)

(1811.) Illiger, *Prodromus*.—Genus *Mormon* instituted for the Puffins.

(1816.) Vieillot, *Analyse*.—Genus *Mergulus* (after Ray) adopted for *Alca alle* Linn. Genus *Larva* instituted for the Puffins. Genus *Alca* "Linn." adopted for *cristatella*.

(1818.) *Transactions of the Linnæan Society*, xii.—Sabine re-names the thick-billed Guillemot, as "Uria Brünnichii;" Leach, a few pages further on, bestows another name on the same bird,—"Uria Francsii."

(1819.) Merrem.—Genus *Simorhynchus* instituted, with *Alca cristatella* Pallas, as type. (Fide G. R. Gray.)

(1820.) TEMMINCK, *Man. Orn.*, ii.—Genus *Phaleris* instituted, with *psittacula* Pall. as type; containing this species and *cristatella* Pall.

(1821.) NAUMANN, *Isis*, p. 779, pl. 7.—The three known species of *Fratercula* ("Mormon," Ill.) are reviewed, with figures of the heads. A fourth species, Mormon *corniculatum*, is added. (Species now twenty-two.)

(1823.) LICHTENSTEIN, *Verzeichniss*, etc.—Alca *camtschatica* Lepechen is renamed "Mormon superciliosum." A certain "Uria Mandtii" is established, which is frequently quoted as a synonym of *Uria columba*, but appears to be rather an imperfect state of plumage of *grylle*.

(1824–5.) STEPHENS. *Continuation of Shaw's Gen. Zool.*, xii., xiii.— The species of the sub-family *Urinæ* are all included in the genus *Uria*; the type of the genus—*grylle*—is re-named "scapularis." *Phaleris* Temm. is adopted for the Starikis, comprehending *psittacula*, *tetracula*, *cristatella* and "pygmæa," the latter being the same as Gmelin's species of that name. *Fratercula* Briss. is adopted for the Puffins, though *Synthliboramphus antiquus* is included in the same genus. *F. glacialis* Leach appears.* Ray's specific name for *Mergulus alle*—melanoleucus—is adopted. *Utamania* n. g.,† based upon *A. torda*, is instituted; *Alca* "pica" is also ranged under it as a valid species,—making its last appearance upon the ornithological stage. (Species now twenty-three.)

(1827.) BONAPARTE, *Zoological Journal*, iii.—Alca *monocerata* Pall., redescribed as "Phaleris cerorhynca."

(1828.) BONAPARTE, *Syn. Birds U. S. in Ann. Lyc. Nat. Hist. N. Y.* ii.—Alca *monocerata* Pall. redescribed as "Cerorhinca occidentalis." In a foot note, under head of "*Phaleris cristatella* Temm.," Bonaparte quotes: "Alca cristatella et pygmæa, crested or flat-billed Auk, Lath. syn. iii. pl. 95, fig. 4. Phaleris cristatella Pl. Color. No. 200.‡ Alca cristatella Vieill. Gal. Ois. p. 297." (!)

(1828.) VIGORS, *Zoological Journal*, iv.—"Uria brevirostris" named. This is undoubtedly the young of a previously known species of *Brachyrhamphus*, but has never been positively identified. It is usually regarded as the young *B. marmoratus*.

(1829.) ESCHSCHOLTZ, *Zoological Atlas*.—Genus *Chimerina* instituted upon Alca *monocerata*, Pall., and the species called "Chimerina cornuta." Genus *Ombria* instituted upon Alca *psittacula*, Pall., upon which Temminck had previously based his *Phaleris*.

(1829.) Kaup. ———.—Genus *Cyclorrhynchus* instituted upon Alca *psittacula* Pall. (Fide G. R. Gray.)

(—?) TEMMINCK, *Planches Coloriées*. (No. 579).—"Uria" *Wurmizusume* described and figured. (Species now twenty-four.)

(1837.) BRANDT, *Bull. Sc. Acad. Imper. St. Petersburg*, ii.—During the time between the close of Dr. Pallas' labors and the appearance of Prof. Brandt's paper, there was a great deal of subdividing and re-arranging of the *Alcidæ*, and much sawing of the air in a variety of ways; but, beyond the addition of three species, nothing new or specially noteworthy was put forth. Prof. Brandt originates a new classification of the Auks, (the first one which lays claim to any truly scientific character), institutes several new genera, and describes four new species, besides re-naming some others.

The Auks are primarily divided into two "tribes," called "Pterorhines" and "Gymnorhines." Under the former are ranged the true Auks, the Guillemots, and the Sea-dove; the latter comprehends all the rest of the family. The character is found in the feathering or nakedness of the nostrils. This scheme is spoken of more at length further on, and therefore need not be here criticised.

* This species must have been previously named elsewhere, since Naumann has it in the Isis in 1821; perhaps in the Trans. Linn. Soc. of 1818, or thereabouts.

† Named in 1816.

‡ Pl. Color. No. 200 represents *camtschatica* Lepechin, not *cristatella* Pallas.

The new genera are numerous. Of these *Brachyrhamphus*, (type *marmoratus*,) *Lomvia*, (type *troile*,) *Synthliboramphus*, (type *antiquus*,) and *Ptychoramphus*, (type *aleuticus*,) are all valid, and were much needed. On the contrary, *Tylorhamphus*, (type *cristatellus*,) *Ceratoblepharum*, (type *arctica*,) and *Gymnoblepharum*, (type *cirrhata*,) were not called for, being antedated respectively by *Simorhynchus* Merrem, (1819,) *Fratercula* Brisson, (1760,) and *Lunda* Pallas. (1811.)

The founding of a subgenus, *Apobapton*, upon the type of *Brachyrhamphus*, is out of order. In the choice of names for the two subdivisions of *Uria* the author is unfortunate in taking the specific designation of the types of these genera, particularly in the case of *Lomvia*, which must stand for the genus of which *troile* is typical, necessitating a change in the specific appellation of one species of that genus, whose synonymy was already overburdened.

The four new species are Phaleris *microceros*, *Brachyrhamphus Wrangelii*, *B. brachypterus*, and *B. Kittlitzii*. Of the three last, *Wrangelii* is only to-day identified; the other two remain unknown, except by Brandt's description. *Brachypterus* is said to have the tarsi longer than the middle toe, which distinguishes it from all the known species of the genus. *Kittlitzii* is evidently a young bird, and probably not a valid species. It is very near *Uria brevirostris*, Vigors, if not the same, and may be the young either of *marmoratus* or *Wrangelii*. The present monograph does not recognize it as valid, leaving only three really new species to be attributed to Brandt's paper.

Brandt identifies and retains Uria *dubia* Pall. under name of Phaleris dubius; *Alca pygmæa* Gm. as Uria *pusilla* Pall., under name of Phaleris pygmæa. *Uria Wurmizusume* Temm., Pl. Color. 579, is renamed *Brachyrhamphus* (*Synthliboramphus*) *Temminckii*. *Alca monocerata* Pall. is renamed *Cerorhina* "orientalis," probably through a lapsus calami for *occidentalis* Bp. (Species now twenty-seven.)

(1836.) Bonaparte, *Geographical and Comparative List.—Phaleris microceros* Brandt is renamed as Phaleris "nodirostra."

(1839.) Vigors, *Zool. Voy. Blossom.*—Alca *antiqua* Gm. is renamed as "Mergulus cirrhocephalus."

(1839.) Audubon, *Orn. Biog.* v.—*Colymbus marmoratus* Gm. is renamed "Uria Townsendii." Audubon's figure of the supposed adult bird may be really *Brachyrhamphus Wrangelii* Brandt. His figure of the supposed young is really the adult *B. marmoratus*.

(1845.) Gambel, *Proc. Acad. Nat. Sc. Phila.*—Uria *aleutica* Pall. is renamed as "Mergulus Cassinii."

(1849.) Gray and Mitchell, *Genera of Birds*, iii.—A great blemish is the inclusion of the Penguins as a subfamily of the *Alcidæ*, coming in between the Starikis and the Murres. Otherwise the arrangement here adopted of the Alcidæ is as faultless as any ever proposed. Three subfamilies are recognized: *Alcinæ* for the true Auks and the Puffins; *Phaleridinæ* for the Starikis; and *Urinæ*, for the Guillemots. (This arrangement is noticed further on in connection with Prof. Brandt's paper, under head of the general characters of the family). *Fratercula* Briss. is adopted for the Puffins; *Phaleris* Temm. for all the Starikis, except Alca *monocerata* Pall., for which *Cerorhina* Bp. is used; *Brachyrhamphus* Brandt, in the same acceptation as used by its founder; *Uria* Briss. for the Guillemots; and *Arctica* Moehring, for the Sea-doves. Under the head of the latter, besides *alle*, are ranged cirrocephalus, Vigors, and Cassinii, Gambel, with the exception of which, the lists of species are very accurate and very full. Alca pygmæa Gmel. is identified with Uria *pusilla* Pallas; *Uria* Mandtii Licht. is used for Cepphus *columba* Pallas.

(1851.) Bonaparte, *Proc. Zool. Soc. London.*—A new genus and species described—*Sagmatorrhina Lathami*, with which Alca labradoria Gm. is identified. (Species now twenty-eight.)

(1856.) Bonaparte, *Comptes Rendus*, xlii.—That portion of the Tableau

Comparatif des Pelagiens which regards the Auks represents very nearly the classification now most in vogue, founded by Mr. G. R. Gray. The family is divided into three subfamilies--*Alcinæ*, embracing only two species; *Phaleridinæ*, comprising all the Starikis; and *Urinæ*, including the Guillemots. It is thus the same as Gray's arrangement, except in excluding the Penguins; but in its minor details it is unique in several featnres. The genus *Pinguinus*, Bonnaterre, is adopted, and *Alca* left for *torda*. *Simorhynchus*, Merrem, is taken for its type, (*cristatellus*) and *Phaleris*, Temminck, for its type, (*psittacula;*) the other small Phaleridines are ranged under *Tylorhamphus* Brandt, except *microceros*, which is put under *Ciceronia*, Reichenbach. *Uria* is subdivided into *Lomvia* Brandt for the larger species, and "Cephus" Pallas for the smaller ones. Most of these points are tenable, but some are not. Some very obvious improprieties are evident in the handling of the species. Thus Bonaparte insists on retaining "occidentalis" and "nodirostra," two names of his own that he knew were antedated, one by *monocerata* Pallas, and the other by *microceros*, Brandt. *Uria columba* is ranged as a synomym of *grylle*, while *Mandtii* is allowed to take its place. The *Uria* "unicolor" Benicken, which, according to the best authority, is only a state of plumage of *grylle*, is given as a valid species, and referred to a different subgenus. In this paper, as in others written towards the close of the life of the great ornithologist, may be discerned an inclination to lead opinion by the mere weight of a name, or force of personal authority.

(1858.) CASSIN, in *Baird's Birds of North America*.—Bonaparte's article just spoken of is made the basis, in a general way, of Mr. Cassin's paper, but with some important modifications. Only two subfamilies are admitted, *Alcinæ* and *Urinæ*, the former comprehending the Auks proper and the Starikis. *Chenalopex* Moehring is used as a subgeneric appellation for *Alca impennis*. *Mormon* Illiger is used for the Puffins, with *Lunda* Pall. and *Fratercula* Briss. as subgeneric divisions. *Phaleris* Temm. is employed generically for the majority of the Phaleridine forms, with *Simorhynchus* Merrem, *Tylorhamphus* Brandt, and *Ciceronia* Reichenbach, as subgeneric divisions. The erroneous assignment of *Tylorhamphus* is the same as that made by Bonaparte. The forms not included under *Phaleris* are each given independent generic rank. A new species of *Cerorhina* is described—*C. Suckleyi*—for a discussion of which the reader is referred further on. Among the *Urinæ*, the genus *Uria* Moehring is subdivided, after Keyserling and Blasius, into two subgenera—*Uria* proper and *Cataractes* Moehring. *Brachyrhamphus* Brandt is adopted for the Murrelets,* with *Apobapton* Brandt as a subgenus.

This article treats of all the known species of the family, and is, in fact, a monograph of the subject, at once very accurate, and, as far as it goes, complete. Excellent descriptions, in most cases original, are given, together with many synonyms, lists of specimens in the museum of the Smithsonian Institution and Philadelphia Academy, and critical and explanatory remarks. Although the present writer does not endorse all of the opinions maintained in this article, he considers it as by far the best that has ever appeared in print. (Species now twenty-nine.)

(1859.) XANTUS, *Proc. Acad. Nat. Sc. Phila.*—*Brachyrhamphus hypoleucus*, a new species, described. (Species now thirty.)

(1861.) BRYANT, *Proc. Bost. Soc. Nat. Hist.*—"A monograph of the genus *Cataractes* Moehring," with full lists of synonyms, and very accurate descriptions. The family is named "Plautidæ" after Klein. The genus is considered in its restricted sense, including only *troile* Linn., *ringvia* Brünn., and *lomvia* Linn., to which a new species, *C. Californicus*, is added. This is a very valuable contribution. (Species now thirty-one.)

* The present writer proposes this English name for the species of *Brachyrhamphus*.

(1862.) Newton, *Ibis, Oct.* From among the many contributions to the Natural History of the Great Auk, this admirable paper is selected for special mention, both as embodying about all that was known upon the subject previous to its publication, and as containing the results of the diligent and careful researches of the author and Mr. J. Wolley, in Iceland. It is probably the best article upon the subject extant; to which the reader may refer in full confidence that he will find an epitome of our present knowledge. Mr. Newton is of opinion that the Great Auk may still live. He attributes the extinction to which it is surely doomed, mainly to direct human interference. The paper is again referred to, and quoted, in the present memoir.

(1867.) Schlegel, *Catalogue of the Museum of the Pays-Bas, livraison* ix. The article "Alca" is in one sense nearly a monograph of the subject, since the greater part of the species of the family are represented in the Museum of the Pays-Bas, and therefore admitted as valid by the author. Unfortunately, however, the author's ultra-conservatism, on matters specific as well as generic, does not allow him to keep pace with the progress of science, and as a consequence, his system of nomenclature and classification is simply curious. One seeks in vain to divine the reason for the maintenance and expression of such peculiar views, unless it be the author's intention to administer a sort of counter-irritant as a remedy against Brehmomania, or to launch a severe satire against the "furor genericus," and other crying evils of the day. Such extreme views, if discreetly indulged for either of the charitable purposes just suggested, are perhaps excusable; the only question is, whether the remedy is not worse than the disease.

Aside from its value as a Museum Catalogue, the present article is chiefly useful for its accurate indications of different stages of plumage, of differences in dimensions of variable species, and as affording some interesting data in the way of locality. The "genus Alca" is made to hold all the *Alcinæ* and all the *Urinæ*. The Starikis appear under the genus *Simorhynchus;* the Puffins under *Lunda*. It is impossible to subject this arrangement to criticism, since in it there is nothing approaching a classification, and arbitrary illogical opinion is not to be brought under critical review. The common Guillemot appears as "Alca lomvia," though no point of synomymy is more incontestible than that its proper specific name is *troile*. *Ringvia* is considered as a variety of the same. *Uria columba* is not regarded as valid, apparently because the wing-patch of *Uria grylle* is well known to vary in its characters. Alca pygmæa Gm., *Uria pusilla* Pall. and *Phaleris microceros* are thrown together under the common name of "Simorhynchus pygmæus." Alca *tetracula* Pall., and Uria *dubia* Pall., are both regarded as the young of *cristatellus*. *Sagmatorrhina Lathami*, Bonaparte, and *Cerorhina Suckleyi*, Cassin, are both referred to Alca *monocerata*, Pallas. Mormon *glacialis* Leach is not recognized. The *Brachyrhamphi* are not included; but the highly characteristic remark occurs, (p. 21) "Il convient d'étudier de rechef les oiseaux décrits sous les épithètes de Kittlitzii, Wrangeli et brachyptera, et même l'Alca marmorata"!

(1867.) Salvadori, *Descr. Alt. Nuov. Ucc. Mus. di Torino.— Uria Craveri* described. This a new *Brachyrhamphus* from California, closely allied to *B. hypoleucus*. (Species now thirty-two.)

Of the thirty-two species noted in the preceding paragraphs, and held to be valid, twenty-eight are contained in the various American collections to which the writer has had access, and are in the present paper identified and described directly from the specimens themselves. The four species not examined are: "Uria" *dubia* Pallas; *Brachyramphus brachypterus* Brandt; *Sagmatorrhina Lathami* Bonaparte; and "Uria" *Craveri* Salvadori. Of the two last the writer has received some information through private channels, beyond that contained in the published papers; of the two first he knows nothing, except from the original descriptions.

A new and very curious species of *Simorhynchus* is described in the following pages, making a total of thirty-three.

II. *Of the characters of the Family, and its sub-divisions.*

The Auks form a very natural family of birds, distinguished by marked and unmistakable characters from any other. With a single exception,* there is no bird found to present in any notable degree a leaning towards the peculiarities of the *Alcidæ;* and the members of the family, without exception, preserve intact those characters which define the group so trenchantly, showing in no single instance a tendency to aberration. The rigidness with which it is possible to circumscribe the *Alcidæ* is in the highest degree satisfactory, in a class of animals in which the recognition and definition of subordinate groups is peculiarly difficult.

The natural place of the family in our ornithotaxis appears as definite as the characters which separate its forms from other birds. By common consent, the *Alcidæ* are regarded as next to the lowest of birds. The degradation of the type or ideal bird which the Auks represent is only carried further in one family—the *Spheniscidæ*. From the latter, which is at the bottom of the scale, we ascend one step to *Alcidæ;* another brings us to the *Colymbidæ* and *Podicipidæ*. These four families constitute the order *Pygopodes*, or the Brachypterous Natatores. The position occupied by the Auks in this order is so evident as not to admit of question.

It is only necessary to allude to the wings of the *Spheniscidæ*, without dwelling upon the point, to separate this family from the Auks. The tetradactylous feet of the other two families distinguish them with equal facility. Auks are brachypterous, brachyurous, tridactylous natatores, with lateral nostrils. This expression is a perfect diagnosis.

The Auks are confined to the northern hemisphere. Some representatives have been found as far north as explorers have penetrated. The great majority live in more temperate latitudes. A more or less complete migration takes place with most species, which stray southward, sometimes to a considerable distance, in the autumn, and return north again to breed in the spring. A few species appear nearly stationary. The most southern recorded habitat of any member of the family is about latitude 21° N., on the Pacific coast of North America, but this is rather exceptional. The species are very unequally divided between the two oceans. The Atlantic has but few representatives compared with the Pacific. On the northern coasts of the latter the family reaches its highest developement; the greatest number of species, of the most diversified forms, are found there, though the number of individuals of any species does not surpass that of several Atlantic species. Comparatively few species are common to both oceans. All the members of the family are exclusively marine.† They are decidedly gregarious, particularly in the breeding season, when some species congregate in countless numbers. Usually one, often two, rarely if ever three eggs are laid, either upon the bare rock or ground, or in crevices between or under rocks, or in burrows excavated for the purpose. Auks are all altrices, and are believed to be chiefly monogamous. The young are at first covered with long soft wooly down; rarely stiffish hairs appear on some parts. The moult is double. The young of the year usually differ from the adults; the latter usually differ in their summer and winter plumages. A very prevalent feature is the possession of crests or plumes, or elongated feathers of a peculiar shape on the sides of the head. All the species walk badly; some scarcely walk at all. The position of the legs with reference to the axis of the body necessitates an upright position when standing. The birds appear to rest on their rumps, with the feet extended horizontally before them, most

* The genus *Pelecanoides*, of the *Halodrominæ* (*Procellariidæ*), in all details of external form, except those of the bill, is essentially like *Mergulus*.

† *Uria grylle* is found on the southern shores of Hudson's Bay; but this fact can hardly furnish an exception to the statement.

of the tarsus touching the ground. The Puffins, however, and a few others, stand well on their feet. All the species but one, fly well, with rapid vigorous motion of the wings, in a straight, firm, well-sustained course. All progress on or under the water with the utmost facility. They are very silent birds; the voice is rough and harsh; the notes are monotoned. They feed exclusively upon animal substances procured from the water.

The uniformity of structure which obtains throughout the family has already been mentioned; the following paragraphs describe this structure in a general way, so far as the details of external form are concerned:*

The general form is stout, compact and heavy. The body is depressed, flattened underneath. The neck is short and thick. The head is large and heavy, usually oval in shape, more or less flattened laterally, more or less drawn out anteriorly, and sloping gradually on all sides to the bill, but sometimes ending abruptly. The plumage about the head is very soft, dense, and short, except those feathers which constitute the peculiar crest or lateral plumes already mentioned. That of the upper parts is very closely imbricated; that of the lower is very thick, compact, elastic, and otherwise eminently fitted to resist the action of water.†

The bill, though constantly preserving certain characteristics, varies to a remarkable degree in the details of its shape. The broad statement may be made, that no two species‡ of the family have bills identical in shape. So unending is the variation in the bill, that in some cases great differences in shape seem of scarcely more than specific consequence, as is especially the case in the genus *Simorhynchus*. The bill in the great majority of species is more or less compressed, sometimes excessively so; it is frequently, however, nearly as wide as high at the base, and more or less subulate. The contour of the bill in many instances deviates from an ordinary standard so much that the shape may almost be called monstrous. A striking peculiarity of the bill in several genera is the presence of supernumerary elements or accessory pieces, taking the form of salient protuberances. These are usually developed on the culmen; in one instance on the gonys; in one at the angle of the rictus; in several along the feathered base of the bill. Besides these appendages, there are often found grooves and ridges on the sides of one or both mandibles. The culmen is always more or less convex; in one instance it is bi-convex. The tomial edges of the mandibles are more or less sinuate; sometimes nearly straight; usually decurved at the tip, and slightly notched; in one instance recurved. The rictus is ample.§ The mandibular rami approach each other with a very narrow angle, and soon join, producing a long gonys, which is usually nearly straight. One genus has a very convex gonys; in two others the gonys runs the whole length of the bill, there being no mandibular rami proper. The bill is entirely horny, except in two species, in which a soft membrane overlaps the base of the upper mandible; and in a third, where a peculiar knob is not strictly corneous.

The nostrils are basal, lateral, marginal, impervious; usually linear, or narrowly oval; in a few instances placed further from the commissural edge of the upper mandible, and nearly circular. The nasal fossæ are usually very evident; are sometimes hidden by feathers; at others are wholly wanting. The extension of the feathers into the nasal fossæ varies in degree, when it occurs. In just about half the species the nostrils are naked; these usually have no true nasal fossæ. In the other half fossæ occur; entirely obtected by feathers in three genera; partially covered in the rest. The significance of these features will receive further attention below.

* The writer hopes to bring forward, at some future time, a memoir on the anatomy of the family.

† Cf. Nitzsch's Pterylography for pterylosis of *Utamania torda*.

‡ Is *Uria ringvia* specifically distinct from *U. troile?*

§ In two genera, in which the excessive compression of the bill produces a very constricted rictus, its amplification is provided for by means of a dilatable skin at the angle of the mouth.

The wings are short. In no instance do they, when folded, reach to the end of the tail. In one species they are so undeveloped in their terminal segments* that the power of flight is abrogated. The first primary is always longest; the rest rapidly and regularly graduated; all taper to a sufficiently fine point. The secondaries are very short, and broadly rounded. The primary coverts are very long, reaching much more than half-way from the carpus to the end of the first primary. The first row of secondary coverts reach nearly to the end of the secondaries. The under wing coverts are very long. The axillars are short or wanting. The wing as a whole is convex above, concave below, narrow, sharp, stiff, somewhat falcate. These points of structure are constant throughout the family.

The tail is very short; its length is contained, on an average, about three times in the length of wing from the carpal joint. It is usually slightly rounded, sometimes nearly square, in a few instances pointed; in a few more the central rectrices are slightly shorter than the next pair. The individual feathers are usually very obtuse at the end. Both sets of coverts are long; the inferior usually reach nearly or quite to the end of the tail.

The feet are small, and placed far back, as has been said. The thighs are contained within the general skin of the body. The legs are feathered nearly or quite to the tibio-tarsal joint. The tarsus is short, sometimes excessively abbreviated, rarely equal to the middle toe without its claw, never (?†) longer. It is usually much compressed, is sometimes almost as sharp as that of *Colymbus*, is frequently nearly as broad laterally as antero-posteriorly. Its covering varies with different genera. It is usually reticulate behind and laterally, with a row of scutellæ in front, which rarely, however, if ever, extend its whole length. In some genera it is entirely reticulate; in others, the scutellation extends on one or both sides. The tarsal envelope varies so much that it is not available as a character for subdivisions higher than generic. The toes are very long; the outer and middle always of nearly the same length; the inner shorter, its claw just reaching the base of the middle claw. There is no hind toe. Dissection reveals the rudiment of a hallux, which, however, is never developed sufficiently to make even a well-marked prominence. The webbing of the toes is complete. The claws are all moderately arched, compressed and acute; the inner edge of the middle is more or less dilated; the middle is always the largest, except in two genera, which present the peculiarity of having a very large semi-circular inner lateral claw, which, moreover, lies horizontally instead of vertically.

That rigid adherence to the type of structure just described which all the species maintain, while facilitating the recognition of the family as a family, is a serious obstacle in the way of defining its subdivisions with precision. With no very abrupt transition from one form to another, and without any very marked modification of general features, the minor groups seem to be formed mainly by the varying combination of the few differences in structure which obtain in the family. The assemblage of characters, rather than the presence or absence of particular features, in most cases determines the genera; and no two species are absolutely alike in all points of form.

——"Facies non omnibus una,
Nec diversa tamen, qualis decet esse sororum."

In one of the ablest papers that has appeared upon this subject, Professor Brandt divides the *Alcidæ* into two subfamilies: those with feathered, and those with naked nostrils. In this arrangement the Guillemots stand next to the typical Auk—*A. torda*. Viewed from any other standpoint the two forms

* *Cf.* Mr. A. Newton's article in the "Ibis" for October, 1862. As there stated, the humerus of *Alca impennis* is of normal size; the antibrachium, carpus and metacarpus, and their quills, are shortened.

† *Brachyrhamphus brachypterus* is said by Brandt to have the tarsus longer than the middle toe.

appear to represent the extremes of structure in the family; particularly in regard to the bill, cultriform in one, subulate in the other The two types are by most authors placed at opposite ends of the generic chain, and separated by all the Starikis. Attentive consideration of all the bearings of the case may very likely result in the opinion, held by the present writer, that the difference between the views of Prof. Brandt and other writers is rather apparent than real. It should be borne in mind that the *Alcidæ* are a family very rigidly circumscribed, and one showing no tendency to aberration, or to connect itself intimately with the families standing next to it on either side. Whether as cause or consequence of this, the fact is indisputable, that the genera of *Alcidæ* are not strung along in a chain whose ends seem as it were to be linked with the genera of other families; they tend, on the contrary, to aggregation in a circle about a common centre. We may take any genus—it matters not which—we shall find its closest ally to the right and to the left; and the circuit shall be complete when all the genera have been considered. To illustrate this point: Prof. Brandt, like all other writers, takes the typical *Alca* as his starting point. With the feathering of the nostrils as a fundamental feature, *Uria* and its subdivisions must come next, then *Brachyrhamphus;* this leading through *Mergulus* into the true Phaleridines, by means of *Ptychoramphus*. Beginning with those Phaleridines with the simplest bills, he progresses to those with more complex bills, ending with *Ombria*, which last, through *Cerorhina*, conducts to *Fratercula*, which ends the series. There is nothing strained or forced in this; the succession of the genera is perfectly natural. But it so happens that *Fratercula* is as closely, or even more closely, allied to *Alca* proper than *Uria* is. We cannot disturb in any essential degree the generic series of Prof. Brandt, but we could with entire propriety go directly from *Alca* to *Fratercula*, and thence backwards over the same track, ending with *Uria*, which would then be at the opposite extreme of the series. It is asserted, without fear of reasonable contradiction, that to begin anywhere in this natural series of genera and progress through it, is to be brought back to the starting point

It is not, perhaps, possible to divide this generic circle without the exercise of some arbitrary jurisdiction. If there be included in it two or more subfamilies capable of precise definition, the fact has eluded the writer's research. There are, however, in the series two places where a dividing line may be drawn. Prof. Brandt drew but one, relying upon the single character which he found to apply so well, albeit it may be an arbitrary one. Other writers have made likewise but two subfamilies, differently framed however; the *Alcinæ*, including the true Auks, together with the Phaleridine forms, united because of their short, stout, high bills; and the *Urinæ*, separated on the ground of their long, slender subulate bills. Others again, particularly Mr. G. R. Gray and Prince Bonaparte, have drawn two lines, recognizing three subfamilies: and this course appears to be the one that holds closest to nature, provided the family be really susceptible of subdivisions higher than generic. By simply reducing Prof. Brandt's fundamental character to the level of one drawn from the general structure of the bill, three subfamilies stand forth with tolerable distinctness. The *Alcinæ* have feathered nostrils and cultriform bills; the *Phaleridinæ*, naked nostrils and cultriform bills; the Urinæ, feathered nostrils and subulate bills. This certainly appears to be a distinction with a difference, and will be so held in the present paper.

The arrangement of the *Alcidæ* here submitted is a modification of Professor Brandt's, providing for the recognition of three in place of two subfamilies. In this particular it is substantially the same as Mr. Gray's, but the sequence of the genera is entirely different, and is nearly that of the first mentioned author. Beginning with typical *Alca* it passes to *Fratercula*, and ends with *Lomvia*, instead of passing to *Lomvia* and ending with *Fratercula*. But in either case the collocation of the genera is essentially the same. It is believed that this sequence of genera cannot be broken in upon to any considerable degree, without the rupture of a natural series as a consequence.

Family *ALCIDÆ.*

CH.—Tridactylous, brachypterous, brachyurous Natatores, with lateral nostrils.

A.—Subfamily ALCINÆ.—Not crested; with feathered nostrils; compressed cultriform bill, much higher than wide at base, without appendages, but grooved on the sides; tail pointed.

1. *Alca.*—Wings rudimental, not admitting of flight.

2. *Utamania.*—Wings fully developed, admitting of flight.

B.—Subfamily PHALERIDINÆ.—Usually crested, or with elongated feathers on head; with naked nostrils; bill variable, always compressed, higher than wide at the base, often with appendages; tail nearly even.

3. *Fratercula.*—Inner lateral claw very large, semi-circular, acute, horizontal; bill excessively thin, its base ridged, its culmen simple, with one curve; under mandible grooved; no crest; palpebral appendages; a furrow in plumage behind eyes; tarsi anteriorly scutellate.

4. *Lunda.*—As in *Fratercula;* culmen with an accessory piece, and two curves; under mandible smooth; long crests; no furrow in plumage; no palpebral appendages.

5. *Ceratorhyncha.*—Inner lateral claw normal; bill without a basal rim; base of upper mandible with a prominent upright horn; rami of lower mandible with an accessory piece; head with elongated feathers; tarsus anteriorly scutellate.

6. *Sagmatorrhina.*—Base of upper mandible overlapped by a soft membrane; no accessory piece on lower mandible; otherwise as in *Ceratorhyncha.*

7. *Simorhynchus.*—Bill variable, usually with irregular outline or with appendages; head with a crest or elongate feathers; tarsi reticulate.

8. *Ptychorhamphus.*—Bill stout, conico-elongate, wide at base, acute at tip; base of upper mandible with transverse striæ; upper border of nostrils dilated, flaring; no crests.

C.—Subfamily URINÆ.—Nostrils more or less completely feathered; bill elongated, more or less slender and subulate, without appendages or vertical grooves; head not crested, (except in one species.)

9. *Mergulus.*—Nostrils nearly circular, not completely feathered; bill stoutest and shortest in this section; tail much graduated; tarsi scarcely compressed, anteriorly broadly scutellate.

10. *Synthliborhamphus.*—Nostrils broadly oval, incompletely feathered; bill stoutish, but much compressed; tail nearly even; tarsi excessively compressed, anteriorly and internally scutellate.

11. *Brachyrhamphus.*—Nostrils oval, feathered; bill small, very slender; tail short, little graduated; tarsi reticulate, very small and slender, not compressed.

12. *Uria.*—Bill about equal to tarsus; gonys half the culmen; nasal fossæ wide and deep, not entirely filled with feathers; upper mandible with no groove at tip; outer lateral claw grooved; tail contained $2\frac{1}{3}$ times in the wing; tarsi reticulate; no furrow in plumage of head.

13. *Lomvia.*—Bill much longer than tarsus; gonys much more than half the culmen; nasal fossæ long and narrow, completely feathered; upper mandible with a groove at tip; outer lateral claw smooth; tail contained $3\frac{2}{3}$ times in wing; tarsi anteriorly scutellate; a furrow in plumage behind the eyes.

III.—*Descriptions of Genera and Species.*

1. Subfamily ALCINÆ.

ALCA, *Linnæus.*

Chenalopex, Mœhring, Av. Gen. 1752, p. 65, No. 68.
Alca, Linnæus, Syst. Nat. i. 1758; and of authors.
Pinguinus, Bonnaterre, Ency. Method. Orn. 1790, p. 28.

Size largest in the family. Form heavy, compact, robust. Head large, ovate, produced forwards. Neck moderately long, thick. Wings morphologically perfect, teleologically rudimental, not admitting of flight, in length from carpal joint to end of longest primary scarcely twice as long as tail; when folded not reaching the tail. Tail short, pointed. Legs short and stout. Webs broad and full. Tarsi compressed; their anterior ridge and superior surfaces of toes scutellate, lateral and posterior aspects reticulate, the plates on the latter very small. Tibiæ feathered nearly to the joint. Bill about as long as the head, large, strong, very deep, exceedingly compressed. Upper mandible with culmen about straight for half its length, then regularly convex. tip obtuse, declinate, scarcely overhanging; a deep groove on its side at base, parallel with the outline of feathers; its side then perfectly smooth for a space, then deeply impressed with six to ten oblique curved sulci. Gape very large, running far back; line of commissure nearly following that of culmen. Eminentia symphysis slight; gonys nearly straight. Lower mandible two-thirds as deep as upper, its sides impressed with six to ten straight, vertical sulci. Feathers about base of mandibles short, very compact; extending downwards from base of culmen, a little forwards, to commissural edge of upper mandible; reaching much further on sides of lower mandible; wholly covering the moderately long, very narrowly linear, impervious nostrils, which are situated just above the commissure.

It is unnecessary to compare this genus with any other. *Utamania*, most closely allied, is at once distinguished by its teleologically perfect wings, though nearly identical with *Alca* in other points of structure. The only known representative of the genus is remarkable, both for its large size, and for not possessing the power of flight, in consequence of which it may be said to represent, in the Northern Hemisphere, the numerous Penguins of the Southern. By many ornithologists it is believed to have very recently become nearly or quite extinct.

Rigid adherence to the law of priority would necessitate the use of a different name for this genus. "Alca" was first applied by Linnæus, in 1744, to the genus of which the bird now called *Fratercula* or *Mormon arcticus* is typical; and even as used by Linnæus in 1758 it has *torda* as its recognized type, according to that rule which regards the species first mentioned as type, when none is otherwise indicated; so that it cannot, with strict propriety, be used at all in this connection. But the name has become so firmly established by common consent and long usage, that it would be ruthless, as well as profitless, to attempt its supercedure by *Chenalopex* of Moehring, 1752; particularly as this latter word has come into extensive employ for an Anserine genus. The genus *Alca*, as framed by Linnæus in 1758, included both *torda* and *impennis;* and when restricted, by the generic separation of these two types, there seems no good reason why the first mentioned should be regarded as more peculiarly typical of the genus than the last. Should *Alca* be reserved for *Fratercula arctica*, or for *Utamania torda*, it will be apparent that numerous unwarrantable innovations necessarily follow; while its employ in connection with *impennis* entails no such consequences.

ALCA IMPENNIS *Linn.*

Chenalopex, Mœhring, Av. Gen. 1752, p. 65, No. 68. "Rostrum conoides, conuexum, ad latera compressum, aliquot sulcis transuersis canaliculatum," etc. Quotes *Anser magellanicus*, Clus. Worm. Raii, Will. Orn. 242, and *Alcæ species*, Linn. ed. vi, gen. 52.

Alca (Chenalopex) impennis, Cassin, Baird's B. N. A. 1858, p. 900.

Mergus americanus, "Charleton, Onom. Zoic. p. 96, No. 10." "Nieremb. Exot. lib. 10, c. 27," fide Donndorff. Not *Mergus americanus* Cassin, 1853.

Alca major, Brisson, Ornithologia, vi, 1760, p. 85, pl. 7.

Alca impennis, Linnæus, S. N. ed. x, 1758, p. 130, No. 2. Id. ibid. ed. xii, 1766, p. 210, No. 2. Quotes *Alca major* Briss. and *Mergus americanus* Clus. Exot. 103. Brünnich, Orn. Bor. 1764, p. 26, No. 105. Gmelin, S. N. 1788, i, pt. ii, p. 550, No. 3. Lath. Ind. Orn. ii. 1790, p. 791, No. 1. Donndorff, Beyträge Zoologische, ii, pt. i, 1794, p. 817. Sander, Grösse u. Schönh. Natur. i, p. 243. Hermann, Tab. Aff. Anim. p. 150. Temminck, Man. Orn. ii, 1820, p. 939. Stephens, Shaw's Gen. Zool. xiii, 1825, p. 51. Bonaparte, Synopsis, 1828, p. 432. Audubon, Orn. Biogr. 1838, iv, p. 316. Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 345. Fleming, Hist. Brit. Anim. 1842, p. 129. Gray, Genera Birds, iii, 1849, p. 637. Thompson, Nat. Hist. Ireland, 1851, iii, p. 238. Macgillivray, Hist. Brit. Birds, 1852, ii, p. 359. Steenstrup, "Vidensk. Middell. for Aaret, 1855; Kjöbenhavn, 1856—57, pp. 33—116." Newton, Ibis, 1862, p.——, (Historical.) Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 13.

Pinguinus impennis, Bonnaterre, Ency. Method. Orn. 1790, p. 29. Bonaparte, Consp. *Gav.* Comptes Rendus, 1856, p. 774.

Description (from the specimen in the Philada. Acad.)—The white spot between the eye and bill is ovate in shape, its upper border a little straightened, its small end towards, but not quite reaching, the bill, its large end extending to, but not around, the eye; the width of the black space between it and its fellow is rather more than half an inch. The back is dusky-black; other dark-colored parts with a good deal of clear brown, especially on the head. The under parts, including the tail coverts, are white, this color running far up on the front of the neck in a narrowly acute angle. The under wing coverts are ashy-gray. The secondaries are narrowly but distinctly tipped with white. The bill is deep black, its sulci dull white. The feet are dark, their precise color at present undefinable.

Dimensions.—"Length about 30 inches;" wing 5·75; tail about 3·00; bill along gape 4·25; chord of culmen 3·15; greatest width of bill ·66; greatest depth of upper mandible 1·00, of lower ·66; tarsus 1·66; middle toe and claw 3·25; outer 3·00; inner 2·25.

The occurrence of this species on the coast of North America has not been authenticated of late years. Perhaps the last instance on record is that given by Audubon on page 316 of the fourth volume of "Ornithological Biography." "The only authentic account of the occurrence of this bird on our coast that I possess, was obtained from Mr. Henry Havell, brother of my engraver, who, when on his passage from New York to England, hooked a Great Auk on the banks of Newfoundland, in extremely boisterous weather." This specimen was not preserved. "When I was in Labrador," continues Audubon, "many of the fishermen assured me that the 'Penguin,' as they name this bird, breeds on a low rocky island to the south-east of Newfoundland." The present writer received similar assurances when in Labrador in 1860—the place designated being the "Funks." Audubon also states that "an old gunner residing on Chelsea Beach, near Boston, told me that he well remembered the time when the penguins were plentiful about Nahant and some other islands in the Bay."

Two specimens only are known to exist in any American museum. One is in the Philadelphia Academy; its history is uncertain. The other, in the Vassar College, at Poughkeepsie, N. Y., is the original of Audubon's plate and description, as stated in the following note from Prof. Sanborn Tenny, favored in reply to questions regarding it: "The Great Auk, presented to Vassar College by J. P. Girand, Jr., Esq., is in a perfect state of preservation. This specimen is the one from which Audubon made his drawing, and it was presented to Giraud by Audubon himself. Neither Giraud nor myself has further knowledge of it than what is contained in Audubon's works."

Concerning Mr. Audubon's specimen, Mr. Cassin remarks (B. N. A., p. 901), that it was "obtained by him (Mr. A.) on the banks of Newfoundland;" upon which statement Mr. A. Newton (Ibis, Oct., 1862) observes: "In 1857 I was assured by Mr. Bell, the well-known taxidermist at New York, who knew Mr. Audubon intimately, that he never possessed but one specimen of this bird; and if we turn to Prof. MacGillivray's 'History of British Birds' (vol. v. p. 359), we find him saying that he never saw but two examples of the species, one in the British Museum, and 'the other belonging to Mr. Audubon, and *procured by him in London*.'" This serves to throw some little light on the history of the specimen now in the Vassar College, Poughkeepsie, N. Y.

In the Annals and Magazine of Natural History for 1864, p. 235, is given, by Mr. Robert Champley, "a list of the present possessors of the birds, skeletons and eggs of the *Alca impennis*:" this gentleman being cognizant of the existence of twenty-seven skins, six skeletons, and fifty-three eggs. Dr. G. Hartlaub (Bericht üb. d. Leist. in d. Naturg. der Vögel for 1864) remarks upon this enumeration: "Es ist dieses Verzeichniss indessen sehr unvollständig. So z. B. geschicht des schönen Exemplares der Bremer Sammlung so wie des prachtvollen Ei's im Museum zu Oldenbung keine Erwähnung." Mr. A. Newton, on the subject of existing specimens, has (l. c.) the following: "If all the stories we received can be credited, the whole number would reach eighty-seven. I should imagine sixty to be about the real amount;" and again: "It is pretty evident that most of the specimens of the Great Auk and its eggs, which now exist in collections, were obtained from Eldey between the years 1830 and 1844.*

Two eggs are contained in the Philadelphia Academy's collection.

Mr. Alfred Newton's paper in the "Ibis" for October, 1862, entitled "Abstract of Mr. J. Wolley's Researches in Iceland respecting the Gare-Fowl or Great Auk (Alca impennis, Linn.)," is exceedingly valuable, being one of the most complete and satisfactory histories of the bird ever published; and may be consulted with the greatest pleasure and profit. The writer is at special pains to correct the very prevalent erroneous impression, that the Great Auk is a bird of high latitudes. His researches warrant his belief that "the Gare-fowl has probably never once occurred within the arctic circle." Mr. Selby's statement (Brit. Orn., ii. p. 433) of its occurrence in Spitzbergen is shown to be unfounded; and notices of its occurrence in Northern Norway and in Greenland are proven to be not wholly worthy of confidence. Mr. Newton brings his extremely interesting history of the bird, as an inhabitant of Iceland, down to the year 1844, when the last birds known to have occurred were caught and killed; and as these may be regarded by some as the last of their race, he gives the particulars of their capture. Mr. Wolley and himself obtained many specimens of bones, but found no traces of the living birds, though he says: "I think there is yet a chance of the Great Auk still existing in Iceland."

UTAMANIA *Leach.*

Alca, Linnæus, Syst. Nat. 1758; and of most authors. Type *A. torda* L.
Diomedea, Scopoli, 1777, fide G. R. Gray. Not of authors.
Torda, Duméril, Zool. Anal. etc. 1806. Same type.
Utamania, Leach, "Syst. Cat. etc. 1816;" Steph. Cont. Shaw's Gen. Zool. xiii. 1825; and of many authors. Same type.

Size moderate; form stout, compact, heavy; head moderate, anteriorly produced, neck thick. Wings of moderate length, but fully developed, admitting

*"Lists of these, which are in the main correct, though I know of a few that are omitted, have lately appeared in the 'Zoologist' for the present year [1862], pp. 7353 and 7386, and almost simultaneously in the 'Field' newspaper (Nos. 423 and 424, pp. 93, 114). Further remarks on them will be found in the former journal (pp. 7387 and 7438)."—Newton, l. c.

of flight, reaching when folded beyond base of tail; more than twice as long as tail from carpal joint to end of longest primary. Tail rather short, pointed, of somewhat stiffened, acuminate feathers, of which the central pair are elongated and tapering. Legs short, stout; tibiæ bare for a short space above joint; tarsi compressed, anteriorly with a single row of scutellæ, posteriorly and laterally finely reticulate, shorter than the middle toe. Toes long, outer nearly equal to middle, inner much shorter; interdigital membranes broad and full; claws short, stout, obtuse. Bill about as long as head, densely feathered for half its length; feathers on upper mandible extending beyond middle of commissure, nearly as far as those on lower mandible. Bill greatly compressed, its sides flat, with several transverse sulci, its culmen ridged, regularly convex; tip of upper mandible declinate, rather acute; its base encircled by a prominent ridge; gonys about straight; commissure straight to tip, then suddenly deflected. Nostrils just above cutting edge of bill, in its feathered portion, just posterior to basal ridge, impervious, narrowly linear.

Comprising a single species, upon the varying plumages of which numerous nominal species were established by the earlier authors. The employ of the present name for the genus, instead of *Alca* of Linnæus, 1758, is perhaps defensible, upon the grounds alluded to; although the reason for the non-acceptance by authors of *Torda* of Duméril as a generic designation is not apparent. It would be easy to find, among the synonyms of the species, a trivial name to replace *Torda*, should it become necessary to use this as a patronym.

UTAMANIA TORDA, (*L.*) *Leach.*

Alca torda, Linnæus, S. N. ed. x. 1758, i. p. 130, adult. Id. ibid. ed. xii. 1766, i. p. 210; adult. Brünnich, Orn. Bor. 1764, p. 25, No. 100; adult. Gmelin, S. N. i. pt. ii. 1788, p. 551. Latham, Ind. Orn. ii. 1790, p. 793, No. 5. Donndorff, Beytr. Zool. ii. pt. i. p. 819. Scopoli, Bemerk. Naturg. i. p. 81, No. 94. Müller, Zool. dan. Prodr. p. 16, No. 136. Pallas, Zoogr. R.-A. ii. 1811, p. 360. Temminck, Man. Orn. ii. 1820, p. 936. Bonaparte, Synopsis, 1828, p. 431. Audubon, Orn. Biogr. iii. 1835, p. 112; v. p. 428, pl. 214. Gould, B. Eur. v. 1837, p. pl. 401. Brandt, Bull. Acad. St.-Petersb. ii. 1837, p. 345. Peabody, Rep. Nat. Hist. Massach. 1840, ii., Birds, p. 401. Fleming, Hist. Brit. Anim. 1842, p. 130. Gray, Genera Birds, iii. 1849, p. 637. Thompson, Nat. Hist. Ireland, iii. 1851, p. 235. Bonaparte, Consp. *Gav.* Comptes Rend. 1856. Bryant, Proc. Bost. Soc. N. H. May, 1861, p. 73. Schlegel, Urinatores Mus. Pays-Bas, 1867, p. 13. Samuels, Ornith. and Oöl. of New England, 1867, p. 564.

Alca (Utamania) torda, Cassin, Baird's B. N. A. 1858, p. 901.

Pinguinus torda, Bonnaterre, Ency. Method. Orn. 1790, p. 29.

Utamania torda, Leach, Stephens. Shaw's Gen. Zool. xiii. 1825, p. 27; quotes "*Alca Hoieri*, Ray, Syn. 119." Macgillivray, Hist. Brit. Birds, ii. 1852, p. 346. Coues, Pr. A. N. S. Philada. Aug. 1861, p. 249. Boardman, Pr. Bost. S. N. H. Sept. 1862, p. 131. Verrill, ibid. Oct. 1862, p. 142. Verrill, Proc. Essex Inst. iii. 1863, p. 160.

Alca pica, Linnæus, S. N. ed. xii. i. 1766, p. 210; immature or winter plumage. Pallas, Spic. Zool v. 1769, p. 12. Fabricius, Fn. Groen, 1780, No. 51. Gmelin, S. N. i. pt. ii. 1788, p. 551. Latham, Ind. Orn. ii. 1790, p. 793, No. 5; var. β and γ. Donndorff, Beytr. Zool. ii. pt. i. 1794, p. 818; quotes "*Mergus Bellonii*, Johnston, Av. p. 225." Müller, Zool. Prodr. p. 17, No. 138. Hermann, Tab. Affin. Anim. p. 225. Pallas, Zoog. R.-A. 1811, ii. p. 361.

Pinguinus pica, Bonnaterre, Ency. Method. Orn. 1790, p. 30.

Utamania pica, Leach, Stephens, Shaw's Gen. Zool. xiii. 1825, p. 30.

Alca balthica, Brünnich, Orn. Bor. 1764, p. 25, No. 101; immature, wanting white line from eye to bill. Gmelin, S. N. i. pt. ii. 1788, p. 551. Müller, Prodr. Zool. p. 17, No. 137. Donndorff, Beytr. Zool. ii. pt. i. 1794, p. 819.

Alca unisulcata, Brünnich, Orn. Bor. 1764, p. 25, No. 102; young, not having obtained full size and markings of bill.

Alca minor, Brisson, Ornithologia, vi. 1760, p. 92, No. 3, pl. 8, fig. 2.
Alca glacialis et microrhyncha, Brehm.

Habitat.—European and American coasts of the Atlantic, from the higher latitudes, in summer, to the 40°, or thereabouts, in winter. Very abundant. Specimens in all the American museums, and most private collections. Breeds in great numbers on the islands in the Gulf of St. Lawrence, and on the coasts of Labrador and Newfoundland; in winter strays south to New Jersey. Arctic seas of both hemispheres. Rare, or accidental in the North Pacific. Japan! (Schlegel, Mus. Pays-Bas.)

Adult, in summer.—Iris bluish. Mouth chrome yellow. Bill, feet and claws black; the former with a conspicuous curved vertical white line occupying the middle sulcus of both mandibles, continuous from one to the other. A straight, narrow, very conspicuous white line from eye to base of culmen, composed of a series of very short stiff setaceous feathers, sunk below the level of the others. Secondaries narrowly but distinctly tipped with white. Head and neck all around, and entire upper parts black; this on the sides of the head, chin and throat lustreless, velvety, tinged with fuliginous or brownish; on the upper parts glossy and more intense in color. Inner webs of primaries light brownish-gray at base. Entire under parts from the throat, including under surfaces of wings white.

Adult in winter.—Upper parts lighter, duller, more brownish-black; the white of the under parts extending to the bill, and on the sides of the head and neck, sometimes quite to the nape.

Young, first winter—Similar to the preceding; smaller, the bill weaker, shorter, less elevated, less decurved at the tip, the culmen, rictus and gonys straighter, the sides of both mandibles smooth, except in the presence of one sulcus; bill brownish-black, the sulcus white. Legs and feet reddish or brownish-black.

Fledgelings.—Bill very small and slender; body clothed with smoky brown or black down, lighter, or tending more or less to grayish-white below.

The white stripe from the eyes to the bill is very variable, though present in the great majority of individuals. It always exists in the adults in summer plumage, but is sometimes absent in specimens, apparently perfectly adult, in winter plumage. Its presence does not seem to be amenable to any very general or constant law: since it may be very evident in very young birds, not yet fully fledged, and again absent in apparently mature specimens, as just stated. In winter specimens it is frequently interrupted and irregular, wanting the sharpness of definition which it has in all cases of adult specimens in summer vesture.

Dimensions: Adult.—Length (average) 18·00, extent about 27·00, wing 7·75, tail 3·50, difference between outer and inner feathers 1·25; tarsus 1·25; middle toe and claw 2·00, outer do. the same, inner do. 1·40; chord of culmen 1·30, its curve 1·50; rictus 2·25; gonys ·75; nostrils to tip ·85; greatest depth of bill, (just anterior to nostrils,) ·90; greatest width of the corneous portion ·30.

Young.—Length 15·00; extent 22·00; wing 7·00; tail 3·00; tarsus 1·00; chord of culmen 1 00; rictus 1·75, gonys ·60; greatest depth of bill ·60; greatest width ·20.

No one of the many synonyms of this species involves any doubtful point, all being based upon the winter plumage, or upon the absence of the white line, or upon an undeveloped condition of the bill. "Alca pica" was the most firmly established of these, having held its ground until 1825 or thereabouts.

2. Subfamily Phaleridinæ.

FRATERCULA, *Brisson.*

Alca, Linnæus, Syst. Nat. 1744; and in part of subsequent editions; and of the older authors.

Spheniscus, Moehring, Av. Gen. 1752. Not of authors.
Fratercula, Brisson, Ornith, 1760; and of many authors.
Lunda, Pallas, Zoog. R–A. 1811; in part.
Mormon, Illiger, Prodromus, 1811; and of most authors. Type *Alca arctica* L.
Larva, Vieillot, Analyse, 1816. (Type *Alca arctica* L. fide Gray).
Ceratoblepharum, Brandt, Bull. Acad. Imper. St. Petersb. ii. 1837, p. 348. Type *Alca arctica* L.

Bill rather longer than the head, or than the middle toe and claw, nearly as high at the base as long, exceedingly compressed, the sides nearly vertical, the base of the upper mandible with an elevated horny ridge, entirely surrounding it; the basal moiety of the upper mandible with its sides perfectly smooth, forming an elongated oblique triangle with two curved sides; terminal moiety with three or four deep very oblique curved grooves, from commissure to culmen, their convexity looking forwards. Under mandible without a basal ridge, the basal moiety smooth, the terminal with grooves, in continuation of those of the upper mandible. Culmen commencing on a level with the forehead, thence regularly declinate, very convex, with unbroken curve, its ridge sharp, the tip acutely pointed, overhanging. Rictus perfectly straight, except at the end; the angle of the mouth occupied by a circular callosity of membranous tissue; gonys ascending, slightly sinuate, the keel sharp, terminating posteriorly in a thin, elongated, almost hamular process. Nostrils placed just over the commissure, linear, long, reaching nearly across the base of the smooth triangular space of the upper mandible. No nasal fossæ; both eyelids furnished with prominent callosities, in one species developing into a slender acute process. No crest; a peculiar furrow in the plumage behind the eyes, as in *Lomvia*. Wings of ordinary length and shape. Tail contained two and three-fifths times in the wing; the lateral feathers slightly graduated, the central pair shorter than the next ones. Tarsus very short, only equal to the inner toe without its claw; stout, scarcely compressed, covered with minute reticulations, except for a short space in front, which is scutellate. Outer toe about equal to the middle; its claw shorter than that of the middle; middle claw much dilated on the inner edge; middle and outer claws slightly curved, not very acute, upright; inner claw very large, greatly curved, forming a semicircle, exceedingly acute, usually lying *horizontal*, not upright.*

A very peculiar, though well known genus of *Alcidæ*, without an intimate ally except *Lunda*. The essential characters lie in the structure and configuration of the bill, the rictal and palpebral appendages, and the shape and position of the inner claw; although there are other features involved. *Lunda* is crested, with no furrow in the plumage, no palpebral appendages, and a very differently shaped bill.

Three distinct species represent the genus, as far as known. They are all peculiarly boreal birds, not coming far south even in winter. One is extremely abundant on the shores of the North Atlantic; another inhabits the North Pacific exclusively; another is more particularly a denizen of the Arctic Ocean at large. They may readily be distinguished as follows:

Species, (3).

I. A slender acute upright horn on the upper eyelid. Black of throat extending to bill.. 1. *corniculata*.

* The peculiar position, no less than unusual shape of the inner claw of this genus is a strongly-marked character, not found in any other except *Lunda*. The great curvature and extreme sharpness of the claw could not be maintained were it vertically placed like the other claws, as it would be worn down by constant impaction against the rocks which the birds habitually alight upon. But in the usual attitudes and movements of the birds it lies perfectly flat on its side, and is so preserved intact. The birds make great use of this claw in digging their burrows or in fighting; and the preservation of the instrument for these purposes is evidently the ulterior design of the peculiar direction of its axis. The birds have the power of bringing it, on occasion for use, into a vertical position. These facts, mayhap, are not generally known. See Pr. A. N. S., Phila., 1861, p. 254.

II. A short blunt process on the upper eyelid. A black ring around the neck, not extending to bill.

Bill moderate; chord of culmen 2·00, the curve 2·10, the ordinate ·30; depth at base 1·40 (average), wing 6·50.. 2. *arctica.*

Bill large; chord of culmen 2·40, the curve 2·60, the ordinate ·45; depth at base 1·70 (average), wing 7·25... 3. *glacialis.*

FRATERCULA ARCTICA (*L.*) *Steph.*

Alca arctica, Linnæus, S. N. x. ed. 1758, i. p. 130, n. 3. Linnæus, S. N. xii. ed. 1766, i. p. 211, n. 3. Quotes *Anas arctica*, Clus., *Lunda*, Gesner, *Pica marina*, Ray, *Psittacus marinus*, Anders. Brünnich, Orn. Bor. 1764. p. 25, No. 103. Gmelin, S. N. i. pt. ii. 1788, p. 549, No. 4. Latham, Ind. Orn. ii. 1790, p. 792, No. 3. Blumenbach, Handb. Naturg. p. 228, No. 1. Müller, Prodr. Zool. p. 17, No. 140. Hermann, Tab. Affin. Anim. p. 150. Donndorff, Beytr. Zool. ii. pt. i. 1794, p. 815.

Lunda arctica, Pallas, Zoog. R.-A. 1811, ii. p. 365, pl. 83. Schlegel, Urinatores Mus. Pay-Bas. livr. ix. 1867, p. 28. (In part. Confounds *glacialis* Leach with the present species.)

Fratercula arctica, Stephens, Shaw's Gen. Zool. xiii. 1825, p. 37. Quotes "*labradora* Gm. Lath." as syn. Fleming, Hist. Brit. Anim. 1842, p. 130. Thompson, Nat. Hist. Ireland, iii. 1851, p. 221. Gray, Gen. Birds, iii. 1849, p. 637.

Fratercula (Ceratoblepharum) arctica, Brandt, Bull. Acad. St. Petersb. ii. 1837, p. 348.

Mormon arctica, Illiger, Prodromus, 1811, p. Naumann, Isis. v. Oken, 1821, p. 783, pl. 7, figs. 5, 6, 7. Audubon, Orn. Biog. iii. p. 105, pl. 213. Oct. Ed. vii. pl. 464. Nuttall, Man. Orn. ii. 1834, p. 548. Bonaparte, Synopsis, 1828, p. 430. Peabody, Rep. Nat. Hist. Mass. 1840, ii. Birds, p. 401. Macgillivray, Hist. Brit. Birds, 1852, ii. p. 365. Coues, Pr. A. N. S. Phila. Aug. 1861, p. 251. Boardman, Pr. Bost. Soc. N. H. Sept. 1862, p. 131. Verrill, Proc. Bost. Soc. N. H. Oct. 1862, p. 142. Verrill, Proc. Essex Inst. iii. 1864, p. 160. Samuels, Ornith. and Ool. of New England, 1867, p. 566.

Mormon (Fratercula) arctica, Bonaparte, Comptes Rendus, Apr. 1856, p. 774. Cassin, Birds N. A. 1858, p. 903.

Mormon fratercula, Temminck, Man. Orn. ii. p. 933. Gould, Birds Europe, v. 1837, p. pl. 403.

Mormon polaris et Grabæ, Brehm.

Alca deleta Brünnich, Orn. Bor. 1764, p. 25, No. 104. Young.

Alca labradorica, Gmelin, S. N. i. pt. ii. 1788, p. 550, No. 6. Based upon the "Labrador Auk" of Pennant, A. Z. 1785, ii. p. 512, No. 428;* and Lath. Syn. iii. i. p. 318, No. 4. "Hab. in terra Labrador; *Arcticæ* magnit. 12 ferè poll. long. Rostr. angustum, mand. sup. obscurê rubra, inf. albida nigro maculata; tempora obscurè alba, gula, alæ, et cauda brevis obscuræ, pedes rubri." Bonnaterre, Ency. Method. Orn. 1790, p, 33. Donndorff, Beytr. Zool. ii. pt. i. 1794, p. 817.

Alca labradora, Latham, Ind. Orn. ii. 1790, p. 793, No. 4. Same basis as that of Gmelin. "Rostro carinato, mand. inf. gibba, ad apicem macula nigra. oculorum orbita temporibusque albidis, * * color corporis ferè ut in arctica," etc.—Not *Sagmatorrhina labradora* Cassin, which is *S. Lathami* Bp.

Spheniscus, Moehring, Av. Gen. 1752, p. 62, No. 64. Based on "Colymbi species et Alcæ species" of Linnæus' sixth edition. "Rostrum subouatum, lateri-

*The following is Pennant's description:—"With the bill an inch and a quarter long. much carinated at top, not very deep, a little convex; upper mandible dusky, lower whitish, marked with a black spot, and angulated like that of a gull; crown and upper part of the body, wings and tail, dusky; lower part white; legs red. Size of the former," (*Arctica.*) "Inhabits the Labrador coast?—Br. Mus."

bus angustissime et perpendicnlariter compressis, cutis callosa dura in basi mandibuli superioris. Ad supercilia cornu breue," etc.

Coasts and Islands of the North Atlantic, very abundant. Rare in the North Pacific, (Pallas,) where replaced by *F. corniculata.* In winter, south on the American Coast to Massachusetts. Breeds on the islands in the Bay of Fundy, (Boardman). Numerous specimens in all American Museums.

Adult (breeding plumage.)—Iris hazel brown. Eyelids vermillion red, the fleshy callosities bluish ash. Base of bill and first ridge dull yellowish, the smooth contained space bluish, rest of bill vermillion red, the tip of the lower mandible and the two terminal grooves yellowish. Legs and feet coral red, claws black. Crown of head grayish black, the edges of which are sharply defined against the color of the sides of the head, chin and throat, and the posterior edge of which is separated by a very narrow but distinct transnuchal stripe of ashy from the color of the back. Sides of head, with chin and throat ashy white; nearly white between the eyes and bill, and with a maxillary stripe or area of blackish ash on either side of the throat. A narrow, distinct line of white along the anterior edge of the antibrachium. Entire upper parts glossy black, with a bluish lustre, continuous with a broad collar of the same around the sides and front of the neck. Under parts from the neck pure white, the elongated feathers of the flanks and sides blackish. Under surface of wings pearly ash-gray; inner webs of primaries and secondaries dull gray-brown, the shafts brown, blackish at tip and whitish towards the base.

Length 13·50, extent 24·00, wing 6·50, tail about 2·25; tarsus 1·00; middle toe 1·40, its claw ·40; outer toe 1·40, its claw ·30; inner toe 1·00, its claw ·40; bill—chord of culmen 2·00, its curve 2·10; depth of bill at base 1·40; rictus 1·25; gonys 1·45: greatest width of bill (which is at base of nostrils) ·60; length of nasal slit ·35.

Young.—Bill much smaller and weaker than in the adult; without the basal ridge, and with only slight indications of the warty callosities at angle of rictus; the terminal grooves wanting, or faintly indicated; the culmen much less convex; the gonys convex and ascending posteriorly, without the sharp hamular process at base. Such are the general characteristics of the young, though full-grown bird. Birds not grown have their bill much smaller still, entirely without grooves or ridges, acute at the apex, the culmen and gonys perfectly straight; the lateral aspect of the bill is almost an equilateral triangle. Bill basally blackish; terminally yellowish. Legs and feet reddish yellow, obscured with dusky. The eyelids want the fleshy processes. In colors of plumage the young birds are almost exactly like the parents, except that the ashy of the sides of the head is tinted with sooty black, more or less directly continuous with the black of the crown, and lightening into a dusky ash on the auriculars and lower parts of the sides of the head.

Nestlings are covered with blackish down, becoming whitish on the under parts from the breast backwards.

This species presents little variation in any respect from the conditions as above described. The dimensions do not vary much, and even the bill is very constant in size, shape and colors. The plumage of the adults scarcely presents appreciable variation.

The protuberance on the lower eyelid is horizontal, and occupies the whole length of the lid. That on the upper eyelid is nearly perpendicular, and higher than broad; but is short, obtuse and never developed into an acute process.

There is absolutely no difference between American and European specimens. The foot note on page 251, Pr. A. N. S. Phila. for 1861, is to be cancelled as wholly erroneous.

No bird of the family of *Alcidæ* is better known than the present species. It is the type of the Linnæan genus *Alca* of 1744, but not of 1758, nor of subsequent editions of the "System." Though so long known, it has few synonyms beyond those resulting from its reference to divers genera. Alca "deleta" Brünnich, is the young bird. So also, beyond a doubt, is the Alca "labradorica" of Gmelin, which has been so differently interpreted by various authors. Bonaparte even says it is *certainly* his *Sagmatorrhina Lathami*, though he does not adopt the name *labradora*, as it would imply a geographical error. Mr. Cassin, however, uses it in connection with the *Sagmatorrhina*. It is based upon the "Labrador Auk" of Pennant. The diagnosis of this author, and that given by Gmelin and Latham, are reprinted above, for facility of reference. If the reader will take the trouble to study these three descriptions, he will not be likely to regard them as diagnoses of *Sagmatorrhina Lathami*.

This species is the type of Moehring's genus *Spheniscus*; and a person addicted to iconoclasm in the matter of nomenclature might cut a fine dash on the strength of this fact.

FRATERCULA GLACIALIS, *Leach*.

Mormon glacialis, "Leach," Naumann, Isis, 1821, p. 782, pl. 7, fig. 2. Not of Audubon and Gould, who figure and describe *corniculata*. Newton, Ibis, 1865, p. 212. Malmgren, Cab. Journ. f. Ornith. xiii, 1865, p. 394; critical discussion of relationships to *arctica*.

? *Mormon glacialis*, Bonaparte, Synopsis B. U. S. 1828, p. 429. Probably only *arcticus*. Boardman, Pr. Bost. Soc. Nat. Hist. Sept. 1862, p. 132; and Verrill, Proc. Essex Inst. iii, 1864, p. 160. Grand Menan, Bay of Fundy. These two authors rely for the locality upon Audubon's authority, very questionable in this instance.

Fratercula glacialis, Leach, Stephen's Cont. Shaw's Gen. Zool. xiii, 1825, p. 40, pl. 4, fig. 2. Gray, Genera Birds, iii, 1849, p. 637.

Mormon (*Fratercula*) *glacialis*, Bonaparte, Tab. Comparatif Pelagiens, Comptes Rendus, xlii, 1856, p. 774. Cassin, Baird's B. N. A. 1858, p. 903.

Lunda arctica, Schlegel, Urinatores Mus. Pays-Bas, ix. livr. 1867, p. 28, in part; "Specimina aliquantulum majora ex insula Spitzbergen."

Coasts of the North Atlantic; but a more boreal species than *F. arcticus*: Arctic Ocean. Spitzbergen. Near Port Foulke, Greenland, (Mus. Smiths. Inst.), "Europe," Greenland, (Mus. Acad. Philada.) Not authenticated as occurring on the coast of Maine.

(No. 24,362, Mus. Smiths., near Port Foulke, Greenland, Aug., 1861; adult; Dr. I. I. Hayes.) With the colors, and much the general aspect of *F. arcticus*. Larger than that species. Protuberance on upper eyelid more decidedly acicular; in fact intermediate in size and pointedness between that of *F. arctica* and *F. corniculata*. Bill much larger, comparatively and absolutely, than that of *arctica*, and differently shaped; its colors about the same. Bill very deep at the base, the basal ridge rising high on the forehead; culmen much arched, towards the end dropping nearly perpendicularly downwards, so great is its convexity. Upper mandible with four decided grooves; the lower with three, being one more on each than is usual in *arctica*. Gonys more convex in outline, yet not produced posteriorly into so acute a hamular process. Length 14·50: extent about 26·00; wing 7·25; tail 2·25; tarsus 1·20; middle toe and claw 1·90, outer do. 1·90, inner do. 1·45; bill: chord of culmen 2·40, its convexity 2·60, ordinate of the curve ·45; depth of bill at base 1·70, length along rictus 1·50, along gonys 1·60; greatest width of bill ·65; length of nasal aperture ·40.

The developement of the bill, changes of plumage, and individual variations of this species are doubtless identical with those of *arctica*. Young birds of the two species might not be satisfactorily distinguishable.

Though this species is so very near *arctica* it is probable that the majority of authors would accord to it specific rank. It is apparently larger in all its parts; the callosity on the upper eye-lid tends in shape towards that of *corniculata*; the bill is not only much larger every way than that of *arctica*, but has a decidedly different shape, owing chiefly to its greater depth at base, as compared with its length, and much greater convexity of culmen. The only questionable relationship is with *arctica;* the bird is certainly not *corniculata.*

This species is usually cited by New England writers as occurring off the coast of Maine in winter. (Grand Menan, entrance of the Bay of Fundy.) In this, however, they only quote Audubon's authority, which is not reliable in this instance, as he himself says that he "rather supposed than was actually certain that the birds observed were large-billed Puffins." The case is rendered still more problematical by the fact that Audubon's "Large-billed Puffin, *Mormon glacialis* Leach," is really the *corniculata* Naumann, described and figured from specimens procured in London, from Mr. Gould, who also, in the "Birds of Europe," mistakes the true *glacialis* Leach for *corniculata* Naumann Subsequent writers will do well to expunge the name of this species from their local lists of the birds of New England. It is exceedingly improbable that the true *corniculata* occurs on the New England coast.

This species is usually cited as having been introduced in Stephens' Continuation of Shaw's General Zoology (1825); but must have appeared some years previous, since Naumann quotes "*Mormon glacialis* Leach," in the Isis, 1821. It was probably named by Leach about 1816–18.

FRATERCULA CORNICULATA, (*Naumann*), *Gray*.

Mormon corniculata, Naumann, Isis v. Oken, 1821, p. 782, pl. 7, figs. 3, 4. (Kamtschatka.) Cassin, Pr. A. N. S. Philada. 1862, p. 324. (Behring's Straits.)

Mormon (*Fratercula*) *corniculata*, Bonaparte, Comptes Rendus, 1856, p. 774. Cassin, Baird's B. N. A. 1858, p. 902.

Fratercula corniculata, Gray, Gen. Birds, iii, 1849, p. 637, pl. 174.

Fratercula (*Ceratoblepharum*) *corniculata*, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 348. Quotes "*Mormon corniculatum*, Kittlitz, Kupfer, i."

Mormon glacialis, Audubon, Orn. Biogr. iii, 1835, p. 599, pl. 293, fig. 1. Id. B. Amer. vii, p.——, pl. 463. Not of authors. Gould, Birds Eur. v, 1837, pl. 404. Not of authors.

? *Fratercula glacialis*, Vigors, Zool. Voy. Blossom, 1839, Ornith. p. 33. Probably not true *glacialis*.

Lunda corniculata, Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 28.

Coasts and Islands of the North Pacific and Arctic oceans. Kamtschatka, (Mus. Acad. Phila.) Sitka, (Schlegel, Mus. Pays-Bas.) Kotzebue Sound, and St. Michael's, Russian America, (Mus. Smiths. Inst.) Southern extension on west coast of America not determined. Not recorded from the North Atlantic.

Adult, breeding plumage. (No. 46,503, Mus. Smiths., St. Michael's, Russian America, June 27, 1866; H. M. Bannister.) Bill very large, especially high at the base for its length, the height being about equal to the chord of the culmen, exclusive of the width of the basal rim; base of culmen and angle of gonys both produced far backward, giving a greatly curved outline to the base of the bill along the feathers of the sides of the head; sides of the bill not distinctly divided into two compartments; nearly plane and smooth in their entire length, with only three faintly pronounced short grooves; culmen exceedingly convex, regularly arched in the arc of a perfect circle; the tip of the upper mandible acute, moderately overhanging, the basal rim broad and prominent; rictus (not including the part beyond the basal rim of the upper mandible) very short, only equal to the height of the upper mandible at base; gonys sinuate, at first convex in outline, then slightly concave; its length but little less than the chord of the culmen.*

Appendage of the upper eye-lid produced into a long, slender, acutely pointed

* The lower mandible in this specimen is so thin near the angle of the gonys as to be transparent. Ordinary type can be read through it.

upright spine; that of the lower eye-lid much as in other species of the genus.

Form otherwise as in *F. arctica* and *glacialis*. Larger than the former, about the size of the latter.

Crown of the head deep grayish black; the patch of this color triangular in shape, narrowing anteriorly to a point at the base of the culmen. Sides of the head white; the furrow in the plumage behind the eye, and the sides of the lower jaw tinged with dark ash. A narrow distinct line of white along the edge of the fore-arm. Entire upper parts very glossy blue-black; a duller, more fuliginous shade of black encircling the neck before, and running forwards on the throat and chin quite to the bill. Other under parts pure white, except a few elongated blackish feathers on the sides and flanks. Under surface of wings dark pearly ash. Legs and feet orange red, the webs tinged with vermillion. Claws brownish black. Palpebral appendages apparently ashy black. Bill yellow, tinged with red, the terminal portion blackish. Rictal callosities brilliant yellow orange.

Length 14·50; extent 24·50; wing 7·25; tail 2·75; tarsus 1·10; middle toe and claw 2·00; outer do. 1·90; under do. 1.35; bill: chord of culmen 2·00, its curve 2·25; rictus from basal rim to tip 1·20; gonys 1·75; depth of bill at base 1·80; its greatest width ·60; length of nasal slit ·40; length of superior palpebral appendage ·35.

This interesting species may be recognized at a glance by the prominent horn over the eye, and the extension of the black collar on the throat to the bill. The bill also differs from that of either of the other species in its shortness, compared with its great depth at the base, and the nearly smooth sides, which are not distinctly divided by a ridge or groove into two compartments. The bill is also comparatively thinner than that of the other species, and differently colored.

Prof. Naumann first described this species from Kamtschatka in his valuable memoir on the genus in the Isis, as above cited. It has been occasionally confounded with *glacialis* Leach, which is quite a different bird. It is a North Pacific and Arctic species, not recorded from the Atlantic. Excellent specimens are contained in the Philadelphia Academy and Smithsonian Institution; one of those in the collection of the last named is probably the original of Audubon's plate of "glacialis."

LUNDA, *Pallas.*

Alca, Pallas, Spic. Zool. v, 1769; in part; and of some older authors.
Lunda, Pallas, (ex Gesn.) Zoog. R.-A. 1811. Type *Alca cirrhata*, Pallas.
Mormon, Illiger, Prodrome, 1811; in part; and of most authors.
Fratercula, Stephens, Shaw's Gen. Zool. xiii, 1825; in part; not of Brisson.
Gymnoblepharum, Brandt, Bull. Acad. Imper. St. Petersburg, ii, 1837, p. 349. Type *Alca cirrhata*, Pallas.

With somewhat the general aspect of *Fratercula*. No horny appendages to the eyelids. No furrow in the plumage behind the eyes. An extremely elongated crest on each side of the head. Upper mandible with only an indication of a basal ridge along its sides; the culmen divided into two parts, whereof the basal is surmounted by a prominent widened ridge, ending abruptly; sides of upper mandible with three well marked curved grooves, widely separated, whose convexity points backwards. Under mandible with its sides perfectly smooth, and its base very convex, not concave. Rictus very sinuate; gonys slightly curved. Feet, wings and tail as in *Fratercula.*

The above diagnosis indicates only the principal features wherein this genus—or subgenus, as might be contended with some reason—differs from *Fratercula*. Except in the bill, eye-lids and crest, the genus is exactly *Fratercula*, but the differences in these points seem sufficient to warrant generic separation.

LUNDA CIRRHATA, *Pallas.*

Alca cirrhata, Pallas, Spic. Zool. 1769, v, p. 7, pl. 1, and pl. 2, figs. 1, 2, 3. Quotes Steller, Nov. Comm. Petrop. iv, p. 421, pl. 12, fig. 16. Gmelin, S. N. i, pt. ii, 1788, p. 553. Quotes Pennant, A. Z. ii, p. 513, No. 432. Latham, Ind. Orn. ii, 1799, p. 791, No. 2. Donndorff, Beytr. Zool. ii, pt. i, p. 822, No. 10. Quotes *Anas arctica cirrhata*, Steller. Sander, Grösse u. Schönh. in Natur. i, p. 244. Hermann, Tab. Aff. Anim. p. 150; and of the other early authors.

Lunda cirrhata, Pallas, Zoog. R.-A. ii, 1811, p. 363, pl. 82. Schlegel, Urinatores Mus. Pays-Bas, 1867, p. 27.

Mormon (*Lunda*) *cirrhata*, Bonaparte, Comptes Rend., 1856, p. 774. Cassin, Baird's B. N. A. 1858, p. 902.

Mormon cirrhata, Bonaparte, Syn. 1828, p. 429. Audubon, Orn. Biogr. iii, 1835, p. 364, pl. 249, figs. 1, 2. (Kennebec R., Me.) Audubon, B. Amer. vii, 1844, p. ——, pl.—. Boardman, Proc. Bost. Soc. N. H. 1862, p. 132. (Maine). Verrill, Proc. Essex Inst. iii, 1864, p. 160. (Maine). Heermann, Pac. R. R. Rep. x, 1859, Route to California, Birds, p. 75. Cooper and Suckley, Pac. R. R. Rep. xii, pt. ii, 1859, p 283.

Mormon cirrata, Naumann, Isis, 1821, p. 781, pl. 7, fig 1.

Fratercula cirrhata, Stephens, Shaw's Gen. Zool. xiii, 1825, p. 40. Vieillot, Gal. Ois. ii, 1825, p. 240, pl. 296. Vigors, Zool. Voy. Blossom, Ornith. 1839, p. 33. Gray, Gen. Birds, iii, 1849, p. 637. Cassin, Pr. A. N. S. Phila. 1862, p. 324.

Fratercula (*Gymnoblepharum*) *cirrata*, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 349.

Arctic Ocean; Coasts and Islands of the North Pacific; on the American side south to California; of occasional occurrence on the Atlantic Coast of North America, (Kennebec River, Audubon: spec. obtained; Bay of Fundy, in winter, Verrill,) Spec. in Mus. Acad. Philada., Mus. Smiths., Cab. Geo. N. Lawrence, author's Cab., etc.

Bill very large and heavy, much longer than the head or middle toe and claw, its depth at base three-fourths its length; excessively compressed, the sides nearly perpendicular, except at base of upper mandible, where they bulge a little. Upper mandible divided into two portions; the basal part with its sides perfectly smooth, bounded along the base by a slight oblique ridge of subcorneous tissue, which is scarcely, however, elevated above the common plane, and is minutely studded with points; bounded above by a prominent wide ridge formed of an accessory corneous piece which surmounts this portion of the culmen; bounded below by the nasal slit; bounded anteriorly by a deep groove whose convexity looks backwards; these four boundaries enclosing a subtrapezoidal space. The terminal part smooth, except in the presence of three widely separated, oblique, curved, deep grooves, whose convexity looks backwards. Lower mandible with the sides perfectly smooth, the base convex, the convexity looking backwards, with slight indication of a ridge of punctulated subcorneous tissue. General outline of culmen convex; this convexity, however, interrupted near the middle by a notch, forming a re-entrant angle between the two parts of the culmen, each of which, taken separately, is convex in outline—the anterior part the most so. Rictus exceedingly sinuate, the tip of the upper mandible being almost perpendicularly hung over that of the lower; the angle of the mouth occupied by a large fibrous or membranous excrescence, nearly circular in outline, turgid in life; in the dry state shrunken and minutely punctulated. This peculiar warty excrescence seems of nearly the same structure as the base of the bill itself, with which it is directly continuous. Nasal slit short, linear, subbasal, placed close to the commissural edge of the upper mandible. Palate and floor of mouth both deeply excavated; the cutting edge of both mandibles exceedingly sharp.

The eyelids are naked along the edge, but present no thickening or unusual fleshiness. The crest springs chiefly from what would otherwise be a naked linear groove in the plumage from the eyes to the extreme occiput. Some of the feathers begin to grow much above, if not a little anterior to, the eyes. The crest in perfectly adult birds is more than *four* inches long. The feathers have exceedingly slender, delicate shafts, and loose, entirely disconnected, though quite lengthy fibrillæ; and a peculiar silky glossiness.

The wings are of the usual size and shape in this family. The tail is comparatively somewhat longer, perhaps, than in any other Alcidine bird; the lateral feathers a little graduated; the central pair shorter than the next, producing an emargination. The legs are as in *Fratercula*. The claw of the inner toe presents the curious character which has already been dwelt upon in connection with *F. arctica*.

Adult.—Bill orange-red; the basal moiety of both mandibles livid horn or enamel color; the punctulated basal ridge, and rictal callosities more yellowish. Legs and feet obscure reddish; the webs bright coral red; claws brownish-black. Edges of eyelids red; "iris pale blue." Crests pale straw-yellow; some of the posterior feathers, which grow from the black part of the head, black at base. Face pure white, abruptly defined. This white occupies the lores and sides of the head to the base of the crest, and encircles the bill, broadly on the sides, narrowly above and below. The black of the crown comes down the forehead to within a fourth of an inch of the culmen; just filling the crown between the crests, and ending with a directly transverse outline. The white on the side of the lower jaw extends to within about the same distance from the under mandible. A narrow, very distinct pure white line along the anterior edge of the fore-arm. Entire upper parts, and under tail coverts glossy black; sides of head and neck, and throat and breast fuliginous brownish-black; other under parts the same, but more grayish; under surfaces of wings smoky gray. Wings and tail black; the inner webs of the feathers brownish-black; the shaft of the first primary whitish on its under surface towards its base.

The preceding description is taken from an unusually fine specimen (No. 46,494, Mus. Smiths. ♂, Sitka, May, 1867), representing the very highest condition of maturity. The crest is more than four inches long. It is not often that such very perfect specimens are met with in collections.

Length between 15·00 and 16·00; wing 7·75; tail about 2·00; tarsus 1·30; middle toe 2·00, its claw ·50; outer toe 1·80, its claw ·40; inner toe 1·25, its claw ·50; bill: greatest depth (a little in front of extreme base) 1·90; greatest width (at angle of mouth) ·90; chord of culmen 2·40, of which the terminal portion is 1·40; rictus about 1·90; gonys 1·60; greatest depth of upper mandible 1·15; nostrils ·25 long.

Young (full grown).—Bill smaller than in the adult, and not so deep at the base; sides of terminal moiety of upper mandible perfectly smooth; chord of culmen 2·00; depth of bill at base 1·40. No crest; slight indications of it in some short yellowish filamentous feathers on the auriculars. White line on fore-arm imperfect. White about head as in the adult; but the black reaches nearly or quite to the base of the culmen and gonys. Otherwise like the adult; the under parts rather more grayish. The bill and feet appear to have been less brightly colored.

This strange bird fairly disputes with *Phaleris psittacula* the claim to be regarded as the oddest of the odd species of this family. The peculiar configuration of the bill strongly characterizes it at all ages, independently of its remarkable head-markings. Though known for about a century, it has received no specific synonyms from any of the writers whose works have been examined in the preparation of the present memoir. Specimens are contained in nearly all the American collections. The bird is authenticated as occurring on the coast of Maine.

CERATORHYNCHA, *Bonaparte*.

Alca, Pallas, Zoog. R.-A. ii, 1811. in part; not of authors.
Phaleris, Bonaparte, Zool. Journ. iii, 1827; not of authors.
Cerorhinca,* Bonaparte, Syn. U. S. Birds, 1828. Type *C. occidentalis*, Bp. = *A. monocerata*, Pall.
Chimerina, Eschscholtz, Zool. Atlas, 1829. Type *C. cornuta*, Esch. = *A. monocerata*, Pall.
Uria, Audubon, B. Am. vii, 1844, in part; not of authors.
Simorhynchus, Schlegel, Mus. Pays-Bas, 1867, livr. ix, in part; not of Merrem.

Base of upper mandible with a large upright horny protuberance. Under mandible with an accessory corneous piece interposed between its rami, near their symphysis. Bill shorter than the head, stout, very deep at the base, tapering rapidly to the tip, much compressed, the sides erect, smooth, the culmen very convex, the rictus gently curved, the gonys nearly straight, except at symphysis, where it is bulging. Nostrils short, linear, subbasal, marginal, impervious. Eye small; no palpebral appendages. No crest; no furrow behind the eyes; slender elongated feathers on each side of the head. Inner lateral claw of usual size, shape and position. Other details of form almost exactly as in *Fratercula*. Size large; general form robust.

This curious genus may readily be distinguished from all others of the family by the characters indicated in the two first sentences of the above diagnosis. The intercalation of an accessory corneous element at the mandibular symphysis is an entirely unique feature in this family. It seems very much like the "interramicorn," as the writer has elsewhere called it, which is found in the albatrosses, as one of the characters which distinguish those birds from other *Procellariidæ*. In the present instance, it is a feature of especial importance and value, as it helps greatly to distinguish this genus from *Sagmatorrhina*, or, to be more explicit, to separate *S. Suckleyi* from *C. monocerata* in every stage of growth.

The affinities of this genus are decidedly with *Fratercula*, after *Sagmatorrhina*, of course. Aside from the peculiarities of the bill, it agrees with the former in most points of structure, except the eyes and inner lateral claw. It does not require comparison with any other genus. It is represented by only a single species, according to the writer's way of thinking,—*Suckleyi* falling most naturally, as well as can be judged at present, in *Sagmatorrhina*.

CERATORHYNCHA MONOCERATA (*Pall.*) *Cass.*

Alca monocerata, Pallas, Zoog. R.-A. ii, 1811, p. 362, No. 414.
Cerorhina monocerata. Cassin, Baird's B. N. A. 1858, p. 905. Cooper and Suckley, Pacific R. R. Rep. xii, pt. ii, 1859, p. 284.
Simorhynchus monoceratus, Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 26. Cites *Sagmathorina* [lege Sagmatorrhina] *Lathami* Bp. and *Cerorhina Suckleyi* Cass. as young.
Phaleris cerorhynca, Bonaparte, Zool. Jour. iii, 1827, p. 53.
Cerorhinca occidentalis, Bonaparte, Syn. Am. Birds, Ann. Lyc. N. Y. iv, 1828, p. 428. Nuttall, Man. ii, p. 538. Vigors, Zool. Voy. Blossom, 1839, Ornith. p. 33.
Ceratorhyncha occidentalis, Bonaparte, Comp. List, 1838, p. 66. Bonaparte, Consp. Gav. Comptes Rendus, 1856, xlii, p. 744.
Ceratorhina occidentalis, Audubon, Orn. Biog. 1839, v, p. 104, pl. 402, fig. 5.
Cerorhina occidentalis, Gray, Genera Birds, iii, 1849, p. 639. Heermann, Pac. R. R. Rep. x, 1859, Route to California, Birds, p. 75.
Uria occidentalis, Audubon, B. Am. vii, 1844, p. 364, pl. 471.

* This word is spelled in a great variety of ways, both by Bonaparte himself, and other authors. We find Cerorhina, Cerorrhina, Ceratorhina, Ceratorrhina, Cerorhinca, Cerorhynca, Cerorhyncha, Ceratorhyncha, Ceratorrhyncha, etc. The orthography above cited is that apparently first given by Bonaparte, but is obviously erroneous.

Cerorhina orientalis, Brandt, Bull. Acad. St.-Petersb. ii, 1837, p. 348. By a lapsus calami for "occidentalis."
Chimerina cornuta, Eschscholtz, Zool. Atlas, 1829, iii, p. 2, pl. 12.

American and Asiatic coasts and islands of the North Pacific. Japan (Perry's U. S. Expl. Exped.), Kamtschatka (Mus. Acad., Philada.), Pacific coast of N. A. from Russian America to Farralone Islands, Cal. (Mus. Smiths. Inst.) Breeds as far south as Japan and California.

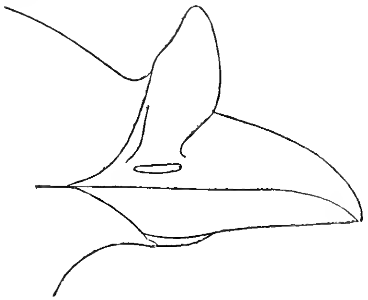

Fig. 1.—*C. monocerata.* Nat. size. Adult female.

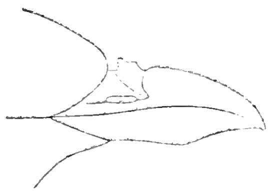

Fig. 2.—*C. monocerata.* Nat. size. Young scarcely fledged.

Adult, breeding plumage, (No. 46,517, Mus. Smiths. ♀, Sitka, May, 1866).—Bill orange-yellow, culmen and base of upper mandible dusky; horn dull yellowish. Feet apparently dusky yellow; below, with the tarsi posteriorly, blackish; claws black. Crown of head, back of neck, and entire upper parts glossy blue-black. Sides of head and neck, and of body along under the wings to the flanks, with chin, throat and upper part of breast, and under surfaces of wings, clear grayish ash, pretty trenchantly defined along its line of junction with the black. Under parts from the breast pure white; this color shading insensibly into the ashy on the breast and sides. A line of white along the edge of the fore-arm. Exposed portions of wing and tail feathers black; their inner webs greyish-brown, basally lighter, the shafts of the primaries dull whitish at base. A series of elongated, stiffish, acicular feathers on the side of the head from the rictal angle; another similar series from the eye backwards to the sides of the nape, pure white. The individual feathers are about an inch, more or less, in length; the length of the white stripes produced by them collectively is about two inches.

Length 15·50; wing 7·25; tail 2·50; tarsus 1·20; middle toe and claw 1·85, outer do. 1·70, inner do. 1·40; chord of culmen, excluding width of horn, 1·00, including it 1·40; rictus 2·00; gonys, including length of accessory piece, 1·10; height of bill from tip of horn to protuberance at symphysis 1·25; from culmen at base of horn to same ·80; nostril to top of horn ·75.

Immature, but with a perfectly developed horn, and accessory symphyseal piece (No. 23,391, Mus. Smiths., Straits of Fuca).—Colors somewhat as in the preceding; but the white of the under parts everywhere obscured by ashy-gray, which tinges the tips of the feathers, giving a marbled aspect to the parts, lightest on the middle of the belly, shading insensibly on all sides into the uniform ashy-gray of the other under parts. Black of upper parts, especially on the head, with a decided brownish tinge. Only traces of the acicular white feathers on the sides of the head. Bill smaller than before; the horn, however, perfectly developed, rising nearly half an inch above the culmen. Rather smaller than the preceding; length between 14 and 15 inches, wing barely 7, bill along rictus 1·60, its depth at base, exclusive of height of horn, ·65.

Young. (No. 23,392, Mus. Smiths., Straits of Fuca).—This specimen is just not quite fully feathered, patches of down adhering here and there. The bill is small and weak, hardly more than half the size of that of the adult; its general shape, however, is nearly attained. The base of the upper mandible is covered with a soft skin, about as far as the end of the nostrils. That part of the culmen formed by the ridge of this skin is sunken below the level of the rest. Unmistakable indications of the future horn are present, in a small knob on the ridge of this skin. In the present dried state this knob is shrunken, presenting the appearance represented in the plate. In life it was probably a small full rounded protuberance, rising a little above the level of the culmen. Between the mandibular rami, at the symphysis, there is a slight fold or ridge of skin, evidently the matrix of the future accessory corneous element. The upper mandible is mostly blackish; the lower dull obscured reddish. The legs and feet appear to have been colored much like those of the adult. The colors of the plumage are precisely those of the specimen last described; the patches of down are smoky brown. There is no trace of white about the head.

Nestling, about 5½ inches long. (Farralone Islands. Mus. Acad. Phila.) All over smoky brown, lighter and more grayish below.

The horn of this bird, always present in the adult, and always indicated, even in the scarcely feathered young, as we have just seen, varies a great deal in the details of its size and shape. It is usually nearly upright, but frequently projects a little obliqely forward. Its average height is between four and five-tenths of an inch, measuring from the level of the culmen at the anterior edge of the root of the horn. The real roots of the horn begin a little above the nasal aperture; the nostril opening just beneath the lower edge. The horn is thus bifurcated, as it were, at the base, and saddled on the base of the upper mandible. The anterior outline is usually straight, or slightly curved, the apex rounded, and the posterior border irregular in outline. The figure represents what is perhaps an average horn. It would be impossible to indicate all the variation in detail; scarcely two horns are precisely alike.

The frontal feathers ascend a very little way up the back of the horn in the majority of instances; sometimes, however, they end abruptly at its base. From their foremost point they sweep downwards and backwards along the side of the upper mandible with a gentle regular curve, to the rictal angle, leaving the tomial edges of the upper mandible bare. The chin feathers begin at the accessory symphyseal piece, rise quickly on the sides of the under mandible, and reach its tomial edge in advance of the rictal angle.

The symphyseal piece, which is developed from the skin at the apex of the interramal space, is, when fully formed, as hard as the rest of the bill. Anteriorly it is directly continuous with the mandibular symphysis. On its sides, a groove indicates its line of cohesion with the mandibular rami. The horn, when mature, is perfectly corneous and hard to its extreme base; there being no soft skin even about the nostrils. Its main shaft is hollow; a tube is disclosed when the top is worn off or broken off.

The white feathers on the side of the head differ from those of other Phaleridines (except *S. Suckleyi*) in not being very slender, filamentous and wavy. They are straight, short, acutely pointed, stiffish, standing discreet from each other, like so many narrow spear-points.

The very large series of this bird examined warrant the belief that the horn is always present, accidents of course not considered; that it begins to be apparent even before the bird is fully fledged, as a slight knob. That, in like manner, the accessory symphyseal piece is always developed; and that its beginning may be detected at a very early age. These facts must be borne in mind in discussing the unusually interesting points connected with *Sagmatorrhina* as compared with the present genus. The opinion relative to the seasonal or sexual character of the horn (page 905, Birds of N. A.)* would probably not have been expressed, had the writer enjoyed the opportunity of examining such an extensive series as have been at command in the preparation of the present monograph.

This species was first named Alca *monocerata* by Pallas in 1811. Prince Bonaparte called it "Phaleris occidentalis" in 1827; which name has been usually adopted, Pallas' description being overlooked or disregarded. Brandt appears to have accidentally misquoted Bonaparte's name in calling the bird "Cerorhina orientalis, Bp." Eschscholtz called it "Chimerina cornuta" in 1829. These are the only synonyms which the writer has been able to collate, except, of course, those resulting from the reference of the bird to diverse genera, as has been already noted.

SAGMATORRHINA, *Bonaparte.*

Sagmatorrhina, Bonaparte, P. Z. S. Lond. 1851, p. 202. Type *S. Lathami*, Bp.

"Bill twice as long as high, upper mandible straight at the base, covered with a very large cere, incurved at the tip; lower mandible ascending immediately beyond the middle, forming an obtuse angle; nostrils linear, marginal."—Bp. l. c.

The above is a translation of the diagnosis of a genus framed by Bonaparte for the reception of a bird he calls *S. Lathami.* It apparently differs from *Ceratorhyncha* in the contour of the bill, the presenee of a soft cere saddled on the base of the upper mandible in the place of a horn, and, it may be presumed, in the absence of the peculiar accessory corneous element at the mandibular synphysis, as no mention is made of such a character. The type and apparently only known specimen is in the British Museum.

The possession of a soft flat cere in place of an upright horn, and the want of the accessory mandibular piece are precisely the features which characterize *Cerorhina Suckleyi* Cassin; and in fact are about the only ones by which the latter can satisfactorily be distinguished, specifically, from *C. monocerata.* It therefore seems a procedure of obvious propriety to refer *Suckleyi* to the present genus. At the same time *Suckleyi* can by no possibility be confounded with *Lathami*; nor is the latter by any means a young *C. monocerata*, as some authors have ventured to hint, and others have boldly assumed. An inspection of the figures accompanying the present memoir ought to set all doubts at rest.

Species—(2.)

"Length 16 inches; wing 7·50; bill 2 long, 1 high, five-eighths wide at the base".. 1. *Lathami.*

Length 14·50; wing 6·50; bill along culmen 1·30, depth at base ·60, width at base four-eighths................................ 2. *Suckleyi.*

SAGMATORRHINA LATHAMI, *Bonaparte.*

? ? ? *Alca labradoria*, Gmelin, S. N. i, pt. ii, 1788, p. 550. Very doubtful. Rather referable to *Fratercula arctica*, which see.

Sagmatorrhina labradoria, Cassin, Baird's B. N. A. 1858, p. 904.

Sagmatorrhina Lathami, Bonaparte, P. Z. S. London, 1851, p. 202, pl. 44.

"Largest among its allies; blackish, beneath pallid fuliginous; bill and feet red; cere and webs black. Length 16 inches; bill 2 inches long, 1 inch high, five-eighths wide at the base, three-eighths in the middle; wing $7\frac{1}{2}$ inches; tail $3\frac{1}{2}$; tarsi $1\frac{1}{4}$; longest toe 2 and 3-eighths inches.

Hab.—"North-west Coast of America.

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* Spec. No. 10698, there enumerated, seems to have called forth the remark above alluded to. This specimen, however, is believed to be the adult of *S. Suckleyi*, of which only the young bird was at that time recognized.

"This species is the largest of the subfamily, which is well known to contain the dwarfs of the water birds; it is one-third larger than *Ceratorrhina monocerata*, of which it has precisely the coloring, wanting only (at least in the state we have it) the little white feathers above the eye and at the corners of the mouth. The proportions of the wings, tail, feet and toes are the same; the bill and toes must have been reddish; the cere and membranes black. Like the *Ceratorrhina*, it seems to be confined to the north-western Arctic region of America; and we are led to believe it does not extend to the Siberian shores, from the circumstance of its not having been noticed by Russian naturalists."

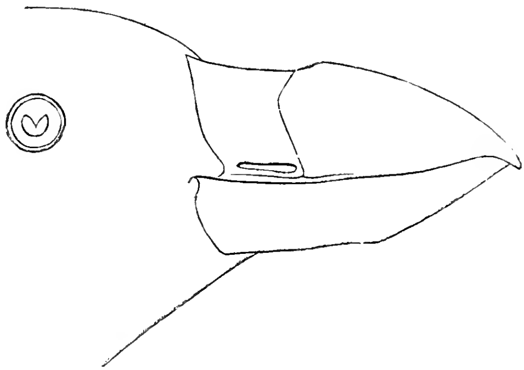

Fig. 3.—*Sagmatorrhina Lathami*, By. Nat. size.

The preceding is Bonaparte's notice of the species, containing all that is known about it by American ornithologists. The writer takes pleasure in acknowledging his indebtedness to Dr. P. L. Sclater, of London, for the accompanying figure, drawn from the type specimen in the British Museum. Dr. Sclater says very positively that the bird is a perfectly valid genus and species, and the figure evidently warrants the assertion. Independently of the difference between the cere and the horn, the shape of the bills of *C. monocerata* and *S. Lathami* are quite diverse. The dimensions of the latter are much larger than those of the former.

SAGMATORRHINA SUCKLEYI, (*Cass.*) *Coues.*

Cerorhina Suckleyi, Cassin, Baird's B. N. A. 1858, p. 906. Based on spec. No. 4579, Mus. Smiths. Young. Puget Sound. Cooper and Suckley, Pacific R. R. Rep. xii, pt. ii, 1860, p. 284. Refers to same specimen.

American and Asiatic Coasts of the Pacific. Spec. in Mus. Smiths Inst — Young, (type of the species, Puget Sound;) adult, breeding plumage (San Diego, Cal.) Adult. (Hakodadi, Japan.)

Adult! breeding plumage! (No. 31908,* Mus. Smiths, ♀, San Diego, Cal. Feb. 3, 1862, J. G. Cooper.) "Iris white; bill black and orange; feet pale yellow, black below," (label.) Bill now obscure yellow, the culmen and basal membrane blackish. Feet dull whitish; tarsi behind and feet below blackish; claws black. Colors of the plumage almost precisely as in the adult *monocerata;* white feathers on sides of head exactly the same. Breast rather deeper grayish-ash, the color extending a little further, and more abruptly defined against the white of the other under parts.

* Figured in Elliot's Birds of North America.

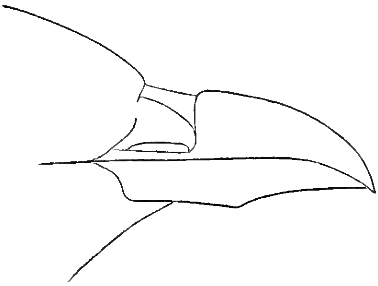

Fig. 4.—*S. Suckleyi*, Adult. Nat. size.

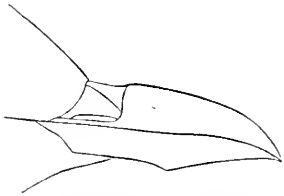

Fig. 5.—*S. Suckleyi*, Juv. Nat. size. Cassin's type specimen.

No vestige of a horn at base of upper mandible; this being covered with a soft skin, overlapping the culmen, extending to the nostrils, which open beneath its lower border. That part of the bill occupied by the membrane is depressed below the level of the rest, both on the ridge and sides. The membrane is shrunken and shrivelled in its present state. There appears to have been a slight tumidity, in the fresh state, of this membrane, just on the ridge, which may have elevated it to the level of the rest of the culmen, and which could possibly even have been inadvertently called a "knob" by one who regarded it as the beginning of a horn. No trace of an intercalated piece between the mandibular rami, which have thin, sharp, smooth edges, and come together in a fine point at the symphysis. Bill much smaller, weaker, and particularly less deep at the base than that of *C. monocerata;* but not much shorter, nor comparatively even so much compressed as in the latter bird. Culmen regularly decurved from base to tip; the latter moderately overhanging; rictus at first nearly straight, then gently declinate; gonys nearly straight, slightly concave; outline of mandibular rami about straight.

Decidedly smaller than *monocerata;* the wing comparatively longer. Length about 14·00; "extent 25·50," (label); wing 7·25; tarsus 1·10; middle toe and claw 1·90, outer do. 1·80, inner do. 1·45; bill: chord of culmen 1·30, of which the membranous part is ·30; rictus 1·85; gonys .75; depth of bill at base ·60; its width at same point ·45.

Young. (No. 4579, Mus. Smiths. Fort Steilacoom, W. T. Jan. 8, 1856. Dr. G. Suckley. Mr. Cassin's type of the species, as described *l. c.*) "Membrane at base of upper mandible grayish dusky black; middle of both mandibles dingy orange, their tips dusky; iris pale hazel; under surface of the webs of the feet, and the posterior aspect of the tarsi dusky black; upper surface of the toes bluish white, darker about the articulations; nails black." (Suckley, l. c.) The colors of the plumage are precisely as described for the young *C. monocerata;* possibly a shade darker, with rather more white on the under parts than in the corresponding age of the other species.

Much smaller than the adult; length "about 12.50; extent 24.00;" (Suckley, l. c.): wing 6·50; tail 2·00; tarsi 1·00; bill along culmen 1·20, of which the membranous portion is ·30; along rictus 1·60; along gonys ·60; its depth at base ·40. The bill is small and slender; its general shape calls to mind the bill of a young gull of one of the smaller species. The several outlines, particularly that of the culmen, are straighter than in the adult; the tip is less decurved. The bill is much longer, relatively and absolutely, than that of the corresponding age of *monocerata;* it is comparatively more slender. There is no trace of a knob;* the membrane has precisely the same characteristics as

* Dr. Suckley (l. c.), speaking of this specimen, uses the word "knob" in connection with it. His expression is to be taken as indicating merely the turgidity of the soft membrane during the life of the bird; which raises the membrane to or above the level of the rest of the culmen. The membrane, being very soft, shrinks and shrivels in drying, and the prominence disappears.

that of the adult bird above described. There is no trace of an accessory piece between the rami.

The bird above described was first indicated as a distinct species by Mr. Cassin in 1858; that gentleman founding his specific characters mainly upon the small size, somewhat darker colors, and much smaller, slender bill, as compared with *monocerata*. The species has always been looked upon with considerable mistrust, and very generally regarded as only a young *monocerata*. At the time of the introduction of *Suckleyi*, *C. monocerata* was not known in all its ages and stages of plumage, as it is at present. The horn which characterizes it was believed to be frequently wanting, particularly in the young bird. The accessory symphyseal piece had not received attention. These facts, together with the almost perfect identity in plumage of the two birds, very naturally led to the suspicion above mentioned; seemingly borne out, too, by the fact that the type of *Suckleyi* was a very young bird, the adult of which was unknown, or at least unrecognized. But it has been shown in the preceding article that indications both of the horn and of the accessory interramal element appear in *monocerata* even before it is fully feathered, and that these two distinguishing features are preserved in all ages, at all seasons, with both sexes. The discovery of *Suckleyi* in perfectly adult breeding plumage settles the question of its identity with *monocerata*. Specimen No. 31,908, above described, has no trace of a horn or accessory symphyseal piece; and is smaller, and otherwise conspicuously different from *monocerata*, though of almost precisely similar colors of plumage.

There is something highly interesting, very singular, and, with our present information upon the subject, totally inexplicable, in the fact that the plumage of the two birds is so nearly identical as not to be satisfactorily distinguished in any particular; while the bills differ in such radical characteristics. The suspicion comes unbidden, that the whole truth in the matter of *C. monocerata*, and *S. Suckleyi*—and *S. Lathami*, too—remains to be developed; while it is certain, at the same time, that nothing but the truth appears upon these pages.

In the reference of this species to the genus *Sagmatorrhina*, the writer is guided simply by Bonaparte's diagnosis, and by the figure of the head of *S. Lathami*, kindly furnished by Dr. Sclater. The dimensions of *S. Lathami* and the form of the bird are sufficient to distinguish *S. Suckleyi* from it.

SIMORHYNCHUS, *Merrem.*

Alca, Pallas, Spic. Zool. v, 1769, in part; and of some authors.
Uria, Pallas, Zoog. R.-A. ii, 1811, in part.
Lunda, Pallas, Zoog. R.-A. ii, 1811, in part.
Simorhynchus, Merrem, ———, 1819. Type *Alca cristatella*, Pall. Fide G. R. Gray. (Where is this genus named?)
Phaleris, Temminck, Man. Orn. ii, 1820. Type *Alca psittacula*, Pallas. (Also includes *cristatella*.) And of most authors.
Mormon, Lichtenstein, 1823, in part. (*M. superciliosa* = *camtschatica*, Lep.)
Ombria, Eschscholtz, Zool. Atlas, 1831. Type *Alca psittacula*, Pallas.
Cyclorrhynchus, Kaup, 1829. Type *Alca psittacula*, Pall. Fide G. R. Gray.
Tylorhamphus, Brandt, Bull. Acad. Imper. St. Petersburg, ii, 1837. Type *Alca cristatella*, Pall.
Ciceronia, Reichenbach, 1853. Type *Phaleris microceros*, Brandt.

Of moderate and very small size; general form stout. Usually with a crest, or with elongated feathers about the head. Bill variable: sometimes simple, oftener irregular in form, with various elevations and depressions, often with nodules or other accessory elements; always stout, compressed, shorter than the head, the culmen very convex, the tip acute. Nostrils entirely unfeathered. Wings and tail of the ordinary shape and length. Feet small and short; tarsus compressed, entirely reticulate, shorter than the middle toe. Toes long, outer and middle about equal in length, the claw of the latter largest. Claw of inner toe reaching base of middle one. Claws much arched, compressed, acute, the inner edge of the middle one scarcely dilated.

The genus as above defined is framed to include a number of species, all more or less closely allied, yet presenting differences from each other in form in almost each instance. The various species are all nearly identical in the structure of the wings, feet and tail; in the bill no two entirely agree. Each presents suæ speciei characters in the shape of the bill; but the very fact that this organ varies so much seems to indicate that the differences are no more than of specific consequence. A glance at the synonyms above adduced will show what forms have been made indicative of genera. *Psittacula* is perhaps the species which has been most generally separated from the others, in view of its oval upper, and falcate under, mandible. But if this bird is to be generically distinguished, so also must *cristatellus;* for the latter differs in still greater degree, in the presence of an anomalous accessory element in the bill. This one being taken out, what to do with *camtschaticus*, so very closely allied? It is almost identical with *cristatellus* in all points of structure, except in the details of the configuration of the bill, and in these points it stands intermediate between this species and some others. Then *microceros* and *pusillus* would have to stand by themselves. So also would *tetraculus* and *Cassini*. These two, particularly, differ more from all the rest, in their short, simple conic bills, than any of the rest do from each other. In fine, if *psittacula* be allowed generic rank, so also must *cristatellus*, and pari passu must no less than three more genera be recognized. It seems much the most philosophical to group all these forms together in a single genus, regarding the differences in the bills as specific.

In such an acceptation, the genus comprises eight species, which may be thus analysed:

Species—(8.)

I. *Phaleris* Temm. Upper mandible oval, under mandible falcate; rictus curved upwards. No crest.
- Blackish; white below from the breast; a white spot below the eye.. 1. *psittaculus.*

II. *Simorhynchus*, Merrem. Upper mandible triangular, under mandible nearly straight; rictus horizontal, sinuate. A long recurved crest.
- Angle of the mouth with a supernumerary corneous piece. Sides of under mandible unfeathered. One series of white feathers on the head .... 2. *cristatellus.*
- Unknown. (See Pallas' description, infrà)............ 3. *dubius.*
- Angle of mouth without a supernumerary piece. Sides of under mandible feathered. Three series of white feathers on head... .... 4. *camtschaticus.*

III. (*Unnamed subgenus.*) Bill very small, short, conic, simple, destitute of any irregularities whatever.
- Large; bill moderately compressed; a long recurved crest; fuliginous black above, fuliginous gray below. Wing 5·50; rictus ·70; width of bill at base ·30; tarsus, middle toe and claw together 2·50.. 5. *tetraculus.*
- Small; bill excessively compressed; no crest (?); uniform plumbeous, lighter below, whitish on the abdomen. Wing 4·25; rictus ·60; width of bill at base ·15! Tarsus, middle toe and claw together, 2·00.. 6. *Cassini*, *n. s.*

IV. (*Ciceronia*, Reich.) Smallest of the genus. Short white hair-like feathers over the forehead.

Length about 6·50; height of bill at base ·30. Upper mandible with a basal knob; bill stout and wide for its length. No decided white patch on scapulars .... 7. *microceros.*

Length about 5·50; height of bill at base ·20. Upper mandible without a knob; bill slender and narrow for its length. Conspicuous white patch on scapulars .... 8. *pusillus.*

The first distinctive name of this genus is said, by Mr. Gray, to be *Simorhynchus* of Merrem, with *cristatellus* as type. This genus is not in general employ. The present writer does not know where it is instituted, but adopts it upon the authority just mentioned. *Phaleris* of Temminck is usually adopted. This genus was framed, in 1820, to include both *psittaculus* and *cristatellus:* the characters as laid down apply best to the latter; the former is mentioned first. It cannot be used for *cristatellus*, however, being antedated by Merrem's name. If *psittaculus* is separated from the present genus, it must be called *Phaleris*, Temm., which antedates *Ombria* Esch., though the latter is usually applied to that bird. *Tylorhamphus* Brandt is simply a duplication of Merrem's genus; *Cyclorrhynchus* Kaup merely repeats Temminck's. *Ciceronia* Reichenbach is based upon the smallest species of the genus—section four in the preceding analysis. Section three of the foregoing synopsis, comprehending *tetraculus* and *Cassini*, is really the most distinct of any, and is the best entitled to generic rank. The chance to run in a name is left open to any one who may be ambitious in that line.

SIMORHYNCHUS PSITTACULUS, (*Pall.*) *Schl.*

Alca psittacula, Pallas, Spic. Zool. v, 1769, p. 13, pl. 2, and pl. 5, figs. 4, 5, 6. Gmelin, S. N. i, pt ii, 1788, p. 553. (Based on Pallas and Pennant.) Latham, Ind. Orn. ii, 1790, p. 794. (Same basis.) Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 822. Quotes Steller, Nov. Act. Petrop. iv, p. 426, pl. 13, figs. 25, 26; and other authorities.

Lunda psittacula, Pallas, Zoog. R.-A. ii, 1811, p. 366, pl. 84.

Phaleris psittacula, Temminck, Man. Orn. i, 1820, p. 112. Stephens, Shaw's Gen. Zool. xiii, 1825, p. 44. Bonaparte, Synopsis, 1828, p. 426. Gray, Genera Birds, iii, 1849, p. 638. Bonaparte, Comptes Rendus, 1856, xlii, p. 774.

Ombria psittacula, Eschscholtz, Zool. Atlas, 1831, iv, p. 3, pl. 17, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 348. Cassin, Baird's B. N. A. 1858, p. 910. Elliot, B. N. Am. 1866, part i.

Simorhynchus psittaculus, Schlegel, Urinatores Mus. Pays-Bas, 1867, livr. ix, p. 24.

Asiatic and American coasts of the North Pacific; Aleutian Islands; Kamtschatka, (Mus. Acad. Philada.); Russian America, (Mus. Smiths. Institution); Behring's Sea, (Schlegel, Mus. Pays-Bas.); Japan?

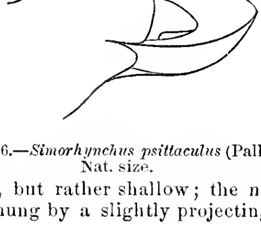

Fig. 6.—*Simorhynchus psittaculus* (Pall.) Nat. size.

Bill moderately large, much compressed, densely feathered for some distance at base of upper mandible and sides of lower. Upper mandible almost perfectly oval in its lateral aspect, its culmen gently curved, and its tomial edges more decidedly convex, the former descending, the latter rapidly ascending to meet at an obtuse angle. Lower mandible extremely slender, falciform in shape, strongly curved upwards, its tip very acute, its tomial edges concave, corresponding to the convex tomia of the upper mandible; the gonys much and regularly curved. Nasal fossæ long and wide, but rather shallow; the nares rather broadly linear, or narrowly oval, overhung by a slightly projecting scale. Frontal feathers embracing culmen in a slightly reëntrant angle, thence descending about perpendicularly to the very edge of the upper mandible. Feathers on side of lower mandible not extending quite so far as those on side of upper. Interramal space fully feathered, but in consequence of the peculiar shape of the rami, there is a small pit or fossa between them, just at their junction, which is unfeathered. Wings and tail of the usual length and shape; the length of the latter contained about three and two-thirds times in the length of the former from the carpal joint to the end of the longest feather. Tarsus shorter than the middle toe without its claw.

Adult.—Without a crest. A series of elongated very slender filamentous white feathers from the eye backwards and downwards, white. Entire upper parts, with chin, throat, breast, and flanks, fuliginous or brownish-black, lighter or grayer below than above; other under parts pure white, pretty trenchantly defined against the darker color of the breast. Bill orange or coral red, becoming enamel yellow at the tip, and along the cutting edges. Legs and feet dull greenish, darker posteriorly, (in the dried state.)

The above is the state of plumage of apparently most mature birds; but is much more rarely met with than the succeeding: Upper parts as just described, but no whitish feathers below and behind eye. Entire under parts white, marbled on the throat, breast and sides with dusky or blackish; this color usually occupying chiefly or wholly the tips of the feathers, whose bases are white. The mottling is thickest on the breast, most sparse on the abdomen; but it varies in degree with almost every specimen. A state of plumage is described as that of the young, in which the white occupies nearly the whole under parts, and is scarcely mixed with dusky, even on the throat and breast. This stage is not represented in American Museums. The tendency of the mottling, as the bird grows older, seems to be to increase on the throat, breast, perhaps on the sides and flanks, and to disappear from the other under parts, leaving the latter pure white, in marked contrast. The under wing coverts are always dark ashy brown; the short tibial feathers the same.

Length about 9·00; wing 5·40 to 5·75; tail 1·50 to 1·60; tarsus (average) 1·00; middle toe 1·10. Bill: chord of culmen ·60, chord of gonys just about the same; depth opposite posterior end of nostrils ·45; width at same point ·30; rictus nearly or about 1·00.

This very curious species may be instantly recognized, in whatever state of plumage, by the remarkable configuration of the bill; the rictus being strongly curved upwards, the upper mandible oval, obtuse, the lower falciform, acute. It is one of the longest and best known of the North Pacific representatives of the family, and is apparently a very common bird, though specimens do not occur in collections so often as might be expected. It seems to be decidedly boreal in habitat, and is not recorded, on the American coast, so far south as the United States, though occurring at Sitka, R. A., and probably off the coast of British Colombia. It has no specific synomyms, though it has been referred to several different genera. It is one of Dr. Pallas' species. It is the type of M. Temminck's genus *Phaleris.*

SIMORHYNCHUS CRISTATELLUS, (*Pall.*) *Merrem.*

Alca cristatella, Pallas, Spic. Zool. v, 1769, p. 20, pl. 3, and pl. 5, figs. 7, 8, 9. Gmelin, S. N. i, pt. ii, 1788, p. 552. No. 7. Latham, Ind. Orn. ii, 1790, p. 794, No. 6. Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 821. Vieillot, Gal. Ois. ii, 1825, p. 242, pl. 297.

Uria cristatella, Pallas, Zoog. R.-A. ii, 1811, p. 370, pl. 86. Erroneously cites as synonymous *Alca camtschatica*, Lepechin.

Simorhynchus cristatellus, Merrem., Bonaparte, Tab. Comp. Pelag. Comptes Rendus, xlii, 1856, p. 774. Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 25. (Considers *U. dubia* and *tetracula* Pall., young of this species.)

Phaleris cristatellus, Stephens, Shaw's Gen. Zool. xiii, 1825, p. 47, pl. 5. Not

of Temminck, Pl. Color. 200, which is *Alca camtschatica* Lepechin. Bonaparte, Synopsis, 1828, p. 426.—Id. Compt. and Geog. List. 1838, p. 66. Vigors, Zool. Voy. Bloss., 1839, Orn. p. 33. Gray, Gen. B., iii. 1849, p. 638.
Phaleris (*Simorhynchus*) *cristatella*, Cassin, Baird's B. N. A. 1858, p. 906.
Tylorhamphus cristatellus, Brandt, Bull. Acad. St. Petersb. ii, 1867 p. 348.
Phaleris superciliata, Audubon, Orn. Biog. pl. 402; oct. ed. pl. 437. Not *Mormon superciliosa* Licht., nor *Phaleris superciliosa* Bonap., which refer to *Alca camtschatica* Lepechin.

Asiatic and American coasts and islands of the North Pacific, to Behring's Straits; perhaps into the Arctic Ocean. Kamtschatka and Behring's Straits, (Mus. Acad. Phila.) Japan, and north-west coast of America, (Mus. Smiths. Inst.) Not known to occur on the American coast so far south as Washington Territory, U. S.

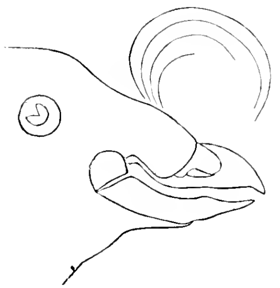
Fig. 7.—*Simorhynchus cristatellus*, (Pallas.) Nat. size.

Bill surpassing that of all other species of the genus in the extent and diversity of the irregularities of its surface and contour; these irregularities chiefly centered in the base and commissural edges, and produced by the addition of a supernumerary corneous element to the base of the upper mandible just at the angle of the rictus, as well as the expansion and projection upwards and outwards of the sides of the lower mandible towards and at its base. Bill, except in the length of its unfeathered commissure, rather short and wide, the length of culmen scarcely surpassing the width of bill at its base. Upper mandible with the culmen short and regularly very convex from base to tip, which latter is rather acute, and slightly overhangs the lower mandible; its tomial edge extremely sinuate and irregular, lightly notched just behind the tip, at the base widened and somewhat everted, for the reception of the cutting edge of the lower mandible; lower mandible not nearly so deep as the upper, somewhat ascending towards the tip, which latter is slender and acute; the gonys short, perfectly straight, moderately ascending, the sides of the lower mandible elongated, everted, their tomial edge elevated and dilated at the base, posteriorly corresponding in contour to the antero-inferior outline of the supernumerary piece. The latter is a subcircular or subquadrate corneous plate, slightly concavo-convex, wedged in between the bases of the tomial edges of the two mandibles, and forming the angle of the rictus; in color and texture it resembles the rest of the bill, of which it is a true component element. Nasal fossæ small and inconspicuous, not deeply furrowed, filled in by corneous substance like the rest of the upper mandible; the nostrils small, short, linear-oblong, placed close by the tomial edge of the mandible, overhung by an arched and much dilated corneous scale. Feathers extending on culmen to a point opposite the angle of the gonys, thence descending perpendicularly along the sides of the bill, just past but not touching the posterior extremity of the nostrils; thence following the sinuosities of the commissural edge of the upper mandible to the supernumerary piece, and around the border of the latter,* but not encroaching upon it. Interramal space of lower mandible densely feathered; but no feathers encroach upon the sides of the lower mandible, contrary to the usual rule in this group.

* This supernumerary corneous element is not attached by its whole surface to the subcumbent bone; but a part of its upper border is free and projects a little away from the skull. The fossa down behind this free raised border is fully feathered.

Wings and tail of the usual shape and structure of this group; the length of the latter contained three and a half times in the length of the former from the carpal joint to the end of the longest primary. Legs short, stout, little compressd. Tarsus entirely reticulate, shorter than middle toe without claw; outer toe as long as the middle one; its claw shorter and smaller than that of the middle one. Inner lateral toe extremely short, the tip of its claw falling far short of the base of the middle claw.

Adult.—An elongated crest of twelve to twenty slender feathers springing in a bundle from one point at the extreme forehead, far in advance of the angle of the rictus, and curving over forwards in the greater part of a circle. These feathers are not truly filamentous, having well developed, though short barbs, and appear narrower than they really are, from the slight obliquity of the barbs from the shaft. A slender bundle of filamentous feathers from the posterior canthus of the eye over the auriculars and sides of the neck. A very few shorter filamentous feathers forming a sparse interrupted superciliary series. All these filamentous feathers white or whitish; the crest concolor with the plumage of the upper parts. General color of the crown, nape, wing, tail, and whole upper parts glossy blackish, with a good deal of a fuliginous or brownish (not plumbeous or cinerous) tint; under parts a diluted shade of the same, or much more brownish gray, tending on the abdomen and posterior under parts generally to ashy gray. Under surfaces of wings and tail like abdomen. Bill and appendages orange or vermillion red, yellowish towards the tip. Feet dusky greenish, an undefinable color, in the dried state.

Length about 9·00; wing 5·25; tail 1·50; tarsus 9·00; middle toe and claw 1·35; outer toe and claw about the same, or slightly less; inner toe and claw 1·00; bill: chord of culmen ·45; tomia of upper mandible, excluding supernumerary piece ·70; greatest width of the latter ·25; tomia of under mandible ·90; gonys ·40; depth of bill opposite posterior end of nares ·45; width at same point ·35.

Young.—Similar to the adult, except in the following points:—The bill is smaller, weaker, less irregular and sinuous in outline, less brightly colored, wanting the expansion and eversion of the tomial edges of the two mandibles near their base, and with little or no trace of the supernumerary piece at the angle of the mouth. Even in the youngest specimens the bill shows unmistakable signs of its fu ure character, and cannot be confounded with the simple conic bill of *tetraculus*, etc. The crest and white setaceous feathers are wanting, or only traces of them are apparent. The color is less blackish, more inclining to a fuliginous dusky above, and to a light dull brownish gray below.

This species never acquires a distinct parti-coloration like that of most species of the genus. With the exception of the whitish filamentous feathers on the head, the colors are uniform over the whole body, varying in shade on different parts; and the transition from the darkest, that of the upper parts, to the palest on the lower is effected by imperceptible degrees. The brilliantly colored bill is a conspicuous feature. The color of the feet cannot be accurately defined in the dried state; but the tints are probably not very striking. The crest only makes its appearance after the bird is full grown, is at least nearly a year old, and has acquired pretty much the perfect shape of the bill The same is true of the white supra- and post-ocular filaments; and generally among the Phaleridine birds, the presence of these peculiar head-ornaments may be relied on as indices that the bird is adult, and that its bill has acquired its mature form. It is just possible, however, that these remarks may not apply to the setaceous *frontal* feathers of *S. microceros* and *pusillus*. The crest of *S. cristatellus* first appears as a little bundle of short straight feathers shooting out backwards from the plumage of the forehead. These plumes, in an early state of their growth, are much broader, that is, with more distinct barbs or fibrillæ, than subsequently; considerable time elapses before they begin to curl over forwards, and they may continue straight until they are an inch or rather more in length. When full grown, they are nigh unto two inches long, curve until they almost make a circle, drooping gracefully, helmet-wise, upon the bill itself. The crest of this and other species is doubtless moved by peculiar muscles, and entirely subject to the control of its wearer, like the very similar crests of the birds of the genus *Lophortyx*.

Simorhynchus camtschaticus is obviously the species most likely to be confounded with the present. In fact, such has been its fate at its hands of so distinguished an ornithologist as M. Temminck. It would be wasting words to institute a comparison between the adults of the two species at this late day. In the youthful condition, before the distinctive head-ornaments are apparent, and even before the bill has attained its perfect form, so characteristic in each case, the two species may be distinguished with equal facility. In *camtschatica*, the basal moiety of the sides of the lower mandible is always feathered; in *cristatellus* this part of the bill is in its whole length always perfectly bare of feathers. This latter feature is, in fact, the most excellent diagnostic character of *cristatellus*; by the aid of which alone the species may always be recognized, be it in never so immature condition, with never so undeveloped a bill. The relationships of this species to *dubius* and *tetraculus* need not be noticed here, as they are given in all necessary detail under the head of these species respectively.

This species was introduced into the records in 1769, by Dr. Pallas, who fortunately gave it a binomial name, thereby securing it from appropriation by Gmelin, who contrived to filch so many species from Pennant, Latham, and other contemporaneous writers. Dr. Pallas first described it as an *Alca*, but afterwards removed it to the genus *Uria*—a very unwarrantable procedure. It is the type of Merrem's genus *Simorhynchus*, and of Brandt's genus *Tylorhamphus*; but not, as generally supposed, of Temminck's genus *Phaleris*, which is based upon *Alca psittacula* Pall. Though thus referred to so many different genera, it has hardly a specific synonym, unless the name on Audubon's plate 402 be regarded as such.

Numerous excellent specimens of this bird are in the collections of the Philadelphia Academy and of the Smithsonian Institution, from the various localities quoted at the head of this article. It is decidedly a boreal species, not recorded from the coast of the United States, though occurring on the Asiatic shores as far south, at least, as Japan.

SIMORHYNCHUS DUBIUS, (*Pallas*) *Coues.*

Uria dubia, Pallas, Zoog. R.-A. ii, 1811, p. 371, pl. 87. "U. rostro fusco simplici, crista frontis pennacea recurva, * * sexu vel ætate tantum a præcedente [*cristatella*] videtur deferre, licet deficientes ad oris angulos calli carnei, et rostrum minus hiulcum differentiam insignem constituant. Cum præcedenti in mari extra Awatscham portum observatur. Irides candidæ. Rostrum sanguineo-fuscum. Pedes coerulescentes. Cæterum *A. cristatellæ* magnitudine et colore simillima."

Phaleris dubia, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 347. Gray, Gen. Birds, iii, 1849, p. 638.

Tylorhamphus dubius, Bonaparte, Tab. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774.

This species, if it be really such, appears appropriately named, since there is nothing to distinguish it from *cristatellus* beyond certain differences in the bill which might with propriety be attributed to an immature condition of the specimen upon which the species was based. And yet the mention of a recurved crest of feathers upon the forehead by Dr. Pallas militates against the supposition that his specimen was not adult. The great reliability which the scientific writings of Dr. Pallas claim, and justly deserve, from their uniform excellence and accuracy, necessitates no small degree of caution in a decision against the validity of one of his species. It will be evident upon the least reflection that, for example, such a perfectly valid species as *tetraculus*, might be so described, in a few sentences, that no striking impression of its difference from *cristatellus* should be conveyed. It is also to be borne in mind that Prof. Brandt, probably unsurpassed by any one in the accuracy and extent of his knowledge of the *Alcidæ*, and particularly well fitted to judge of Dr. Pallas' works, admits the species in question as distinct. And in the present instance it seems preferable to coincide with the views of these naturalists, and to allow the species to hereafter stand upon its own merits, until the proof that it has none is forthcoming, notwithstanding Dr. H. Schlegel's summary assignment of it (as well as of *tetraculus*) to *cristatellus*.

There is no specimen purporting to represent this species in any American Museum; and the only information regarding it which can be furnished at present writing is embodied in the above citation from the "Zoographia." It is hardly, if at all, noticed by other writers than those here cited. Mr. Cassin, however, queries it as a synonym of *cristatellus*.

SIMORHYNCHUS CAMTSCHATICUS, (*Lepech.*) *Schl.*

Alca kamtschatica, Lepechin, Nova Acta Petrop. xii, 1801, p 369, pl. 8.
Phaleris camtschatica, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 347. Gray, Gen. Birds, iii, 1849, p. 638. Cassin, Baird's B. N. A. 1858, p. 908.
Tylorhamphus camtschaticus, Bonaparte, Tab. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774.
Simorhynchus camtschaticus, Schlegel, Urin. Mus. Pays-Bas, 1867. livr. ix, p. 25.
Uria mystacea, Pallas, Zoog. R.-A. ii, 1811, p. 372, pl. 89. Quotes *Alca camtschatica* Lepechin, having just previously cited it for *cristatella*.
Phaleris cristatella, Temminck, Pl. Color. No. 200. Not of authors.
Mormon superciliosum, Lichtenstein, Verzeich. 1823, p. 89.
Phaleris superciliosa, Bonaparte, Comp. and Geog. List, 1838, p. 66.

North Pacific Coasts. Unalaschka, (Pallas.) Kamtschatka, (Mus. Bost. Nat. Hist. Soc.) North-west coast of America, (Mus. Smiths. Inst.)

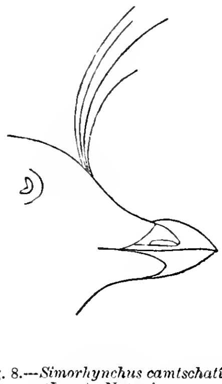
Fig. 8.—*Simorhynchus camtschaticus*, (Lep.) Nat. size.

Bill much smaller, simpler, and differently shaped from that of *S. cristatellus*, though not distantly resembling the juvenile undeveloped condition of the latter. Width at nostril very slightly less than depth at same point, about two-thirds of the length of culmen; bill regularly ≻ shaped in lateral outline; culmen very convex, regularly arched from base to tip; gonys nearly straight, rapidly ascending; commissure slightly sinuate, a little curved upward at tip; apices of both mandibles acute, fairly meeting each other on the level of the commissure; tomia of upper mandible slightly nicked near the tip of the bill. Wings and tail of usual shape for this genus; the length of the latter contained about three and a half times in the length of the former from the carpal angle to end of first primary. Tarsus much shorter than middle toe and claw; middle toe a little shorter than outer toe; middle toe and claw just as long as outer toe and claw; inner toe and claw a little shorter than middle toe without its claw.

The form of the bill alone is characteristic; the other details of structure are shared by the rest of the *Simorhynchi*.

A very long recurved crest of exceedingly slender, delicate, filoplumaceous feathers, six (to ten?) in number, springing from the anterior part of the forehead, about opposite the anterior edge of the orbits, brownish-black; a single series of slender filamentous feathers from each side of the base of the culmen, and thence to the superior border of the orbit; a second similar but shorter series from the edge of the commissure, and thence along the lower part of the side of the jaw; a third similar series from the posterior can hus of the eye, and thence adown the side of the neck; yellowish white. Body colors almost uniform; brownish black, sometimes with more of a grayish, sometimes with more of a fuliginous hue; the wings and tail most intense in color, frequently nearly black; the under parts, particularly the belly, lighter and more grayish brown, inclining to mouse color. Bill orange red, its apex salmon color, or more decidedly yellowish. Legs (in the dried specimen) posteriorly dark brown, anteriorly lighter, more reddish-brown; feet dull brown; claws reddish-brown.

Length of body (approximately) 8·00 inches; wing 5·60; tail 1·60; bill: chord of culmen ·45; depth at base ·28, width at base nearly the same; length of rictus ·95; tarsus 1·00; middle toe 1·25, its claw ·35; outer toe 1·30, its claw ·30; inner toe and claw 1·10; length of outstretched crest 1·40; length of longest whitish feathers over eye 1·00.

Os hyoides examined: The apohyals are slender cylindrical bones ·6 long, slightly knobbed at the end, devaricating at an angle of about 40°. The ceratohyals are absent in the specimen. The urohyal is a delicate style for ·10 of an inch, then suddenly expands into a broad, flat, very thin spatulous lamina, subrectangular in shape, or rather cordate, transversely concavo-convex. This lamina is as long as the rest of the urohyal, and its breadth is rather greater than the length of the stylous portion. The basi-hyal is ·15 of an inch long, slender and cylindrical; bearing upon its apex an exceedingly thin, expanded, somewhat cochleariform glosso-hyal. No opportunity has presented itself of examining the tongue bones of other species of the family.

The present is a long and well known species. First made known, at the beginning of the present century, by Lepechin, (see above) it was redescribed as *Uria mystacea*, in the Zoographia Rosso-Asiatica, by Dr. Pallas, whose expression "* * pennulis setaceis albis elongatis superciliaribus *mystaceisque*," leaves no room for doubt as to the species he had in view. It was redescribed in 1823 by Prof. Lichtenstein, under the name of *Mormon superciliosum*. Unfortunately, it furnished the subject of Planche Coloriée, No. 200, at the hands of M. Temminck, under the palpable pseudonym of *Phaleris cristatella;* which event might have been the occasion of confusion and uncertainty, were the bird a less strongly characterized species. As it is, there is no difficulty in detecting and correcting M. Temminck's error. *S. camtschatica* is so very distinct from *cristatella*, that no special comparisons of the two are required. It is only necessary to point to the configuration of the bill, and the presence of superciliary and maxillary filoplumes, for their ready discrimination. For the rest, the present is a much smaller species than *cristatellus;* and the plume is perhaps longer, certainly less recurved, usually composed of fewer feathers, which are rather more filamentous. The setaceous feathers are essentially arranged, as may be seen above, in three distinct sets or bundles; one from the side of the bill along the commissure and lower part of the cheeks; one from the culmen over the eye, and a third from the posterior canthus of the eye backwards over the auricular region and side of the neck; though the first and last sets may appear more or less directly continuous with each other. It is possible that the plumage described above may not be the most perfect one; still, the perfect development of the crest and other ornaments warrants the belief that the bird from which it was taken is an adult. Authors speak of the under parts, particularly the abdomen, as being frequently nearly white; which may be the coloration of those parts in very mature or very old birds.

At present writing only one perfect specimen of this species is known to exist in any American Museum. The Boston Natural History Society possess this one; No. 9209 of the Museum Register, No. 8135 of the Fresnaye collection, now owned by the Society. The Smithsonian Institution has a mutilated specimen, (ah ead only), from the north-west coast of America, presented by Mr. John Gould. As far as can be judged, it belongs to a bird rather more perfectly plumaged than the Boston Society's specimen.

SIMORHYNCHUS TETRACULUS, (*Pall.*) *Coues.*

Alca tetracula, Pallas, Spic. Zool. v, 1769, p. 23, pl. 4, and pl. 5, figs. 10, 11, 12. Gmelin, S. N. i, pt. ii, 1788, p. 552, No. 8. Quotes Dusky Auk, Pennant, Arct. Zool. ii, p. 515, No. 435. Latham, Ind. Orn. ii, 1790, p. 794, No. 7. Quotes Pallas, Spic. Zool. Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 821.
Uria tetracula, Pallas, Zoog. R.-A. ii, 1811, p. 371, pl. 88.
Phaleris tetracula, Stephens, Shaw's Gen. Zool. xiii. 1825, p. 46. Brandt, Bull. Acad. St. Petersb, ii, 1837, p. 347. Gray, Genera Birds, iii, 1849, p. 638. Elliot, B. N. A. 1867, part iii.
Tylorhamphus tetraculus, Bonaparte, Tabl. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774. Erroneous assignment of Brandt's genus *Tylorhamphus*, which is based upon *cristatellus*.
Phaleris (*Tylorhamphus*) *tetracula*, Cassin, Baird's B. N. A. 1858, p. 907.

Asiatic (and American?) coasts of the North Pacific. "In mari orientali, præsertim Unalaschka," (Pallas.) Kamtschatka, (Mus. Acad., Philada., and Mus. Smiths. Inst.) Bay of Yedo, Japan, (Mus. Smiths. Inst.)

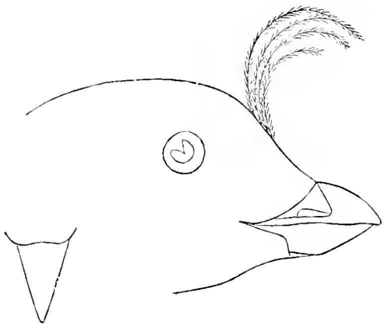

Fig. 9.—*Simorhynchus tetraculus* (Pall.) Nat. size.

Bill small, short, much compressed, regularly conical from a lateral view, simple, being without decided sulci, ridges, caruncles or other irregularities of surface of any sort; culmen narrow, regularly moderately convex from base to tip; commissure and gonys perfectly straight in their whole length; the tip of the bill turned neither up nor down, but the points of both mandibles almost meeting on the level of the commissure. Nasal fossæ scarcely discernible as such, the upper border of the small, basal, linear nostrils being flush with the rest of the bill. Frontal feathers extend forward with an obtusely rounded outline on the culmen, then rapidly recede backwards as they pass downward in a straight line just past the posterior end of the nostrils to the commissural edge of the upper mandible; those on the side of the lower mandible extending not quite so far, but the interramal space fully feathered Wings rather longer than usual in this group; legs, feet, and tail as in other species of the genus, the legs perhaps a little longer, comparatively, than in other species. A crest of ten or more slender elongated feathers with loosened fibrillæ springs from the middle of the forehead, just before the eyes, and curves forward in the greater part of a circle to near the tip of the bill. A very few filamentous feathers on the sides of the head, the slender series beginning at the posterior canthus, and thence extending downwards and backwards. A small white spot just below the eye. Everywhere dull blackish, or dusky; deepest on the back, becoming more of a smoky or brownish-gray on the under parts; under wing coverts like the rest of the under parts; crest colored like the back. Bill an undefinable dusky* in the dried specimen; legs and feet livid gray, (probably greenish or bluish in life); membranes black; claws black.

Dimensions.—(Spec. in Mus. Acad., Phila.) Length about 8·50; wing 5·50; tail 1·60; chord of culmen ·35; gape ·60; gonys ·25; greatest height of bill ·33, greatest width ·25; tarsus 1·00; middle toe and claw 1·50, outer 1·40, inner 1·25.

Another specimen, (No. 22,258, Mus. Smiths. Inst.) Wing 5·60; tail 1·75; chord of culmen ·40; gape ·80; gonys ·40; height at base of bill ·40; width at same point ·30; legs and toes as in the preceding specimen.

Three specimens of this species examined: one in the Philadelphia Academy from Kamtschatka, which served as the subject of Mr. Cassin's description in the "Birds of North America;" another in the Smithsonian Institution, (No. 22,258,) received from the Bremen Museum, labelled "Phaleris cristatella, (Pall.); Winterkleid; Kamtschatka;" another also in the Smithsonian, (No. 15,805,) labelled "Phaleris cristatella; Bay of Yedo, Japan; Apr. 1854; eye gray; iris black; Rodgers' North Pacific Exploring Expedition." The last mentioned specimen is in a very poor state of preservation, and is a young bird, as evidenced by the short straight crest, directed backwards; though the bill is nearly perfect in size and shape, and the general aspect of the bird is precisely that of the adult. The other two specimens are in fine condition, and represent the perfectly mature state. These three include all that are known to exist in any American Museum. It is not a common bird in collections, and is frequently mistaken for the young *cristatellus*, to which species, however, it bears only a distant and superficial resemblance.

The bird here described is indubitably the "Dusky Auk" of Pennant, a species more perfectly and satisfactorily described and figured by Dr. Pallas as *Alca tetracula*. It is a strongly marked species, not distantly allied to, and somewhat resembling *cristatellus* in everything but the bill, which is of a radically different formation, as will be impressed upon the mind by a perusal and comparison of the descriptions given under head of these species. *Tetraculus* requires no special comparison with *cristatellus* or with *camtschaticus* for the substantiation of its distinctness. *S. Cassini* of this paper is the most closely allied species, and might just possibly be confounded by a careless or ignorant observer. The differences will be found under head of the latter.

The diagnostic points of this species lie chiefly in the small size and peculiar shape of the bill (cf. descr.); the length of the wings, proportionally greater than in any other species of the genus; and the greater length of the feet and toes. The wings, tail, feet and toes are about of the same absolute dimensions as those of *cristatellus*, although *tetraculus* is rather a smaller bird. The various shades of the dark color of the plumage are produced by admixture of black, brown and gray; there is no pure cinereous or plumbeous on any part of the plumage.

This is a species which entered at a very early day into ornithological literature, notwithstanding which it has not a single accredited synonym. Its claims to recognition as a valid species, distinct from *cristatellus*, have not been impugned, except by the learned Director of the Museum of the Pays-Bas. It has been the occasion of no confusion or conflict of opinion among writers, except in those few instances in which it has been erroneously supposed to have furnished the subject of Audubon's plate of *cristatellus*. The most cursory examination of the plate will convince the mind upon this point. Mr. Pennant, in virtue of his "Dusky Auk," which is this species, would have been entitled to the proprietorship of the bird, had he given it a binomial name; but as it is, Dr. Pallas stands as its lawful sponsor, having christened it *Alca tetracula* in 1769.

* Pallas gives its color as "fusco-rubrum;" Gmelin, as "ex fusco-lutescens;" Latham, as "luteo-fuscum."

SIMORHYNCHUS CASSINI, *Coues, n. sp.*

Phaleris Cassini, Coues, mss.

DIAG.—S. rostro parvo, breve, valdè compresso, longitudine vix altitudinem excedente, latitudine dimidii altitudinis; ferè triangulare a spectu laterale; simplice, nec ullis additamentis corneis instructo; culmine leviter declinato-convexo, rictu recto, carinâ ferè rectâ, a scendente; suprà nigro-plumbeus, vertice, alis caudâque nigerrimis; subtus griseo-plumbeus, abdomine crissoque sensim albicantibus; longitudo tota corporis 7·75 (poll. Ang.); alæ 4·25; caudæ 1·40; tarsi ·80; digiti medii cum ungue 1·20; rostri ·40, alt. ·30, lat. ·15! rictûs ·60.

Typical and unique specimen, No. 46,564 of the Smithsonian Museum; a male (adult?) collected Aug. 3, 1866, at Ounimak Pass, Russian America, by W. H. Dall.

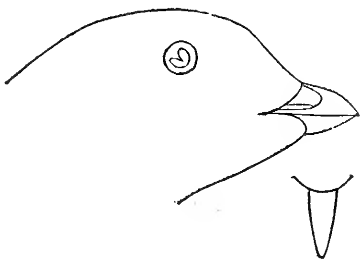

Fig. 10.—*Simorhynchus Cassini*, nov. sp. Nat. size.

Bill very small and short, only half as long as the tarsus; extremely compressed, being hardly more than half as wide as high at the base; its height at base three-fourths the length of culmen; lateral aspect of the bill nearly triangular; culmen regularly lightly convex in outline; rictus perfectly straight; gonys almost straight, ascending; tip of bill rather obtuse; no tubercles, sinuosities, or other irregularities of surface or of contour. Nasal fossæ well marked, oval in outline, reaching the culmen at its base, separated by a ridge from the commissural edge of the upper mandible; nostrils low down in the fossa, small, short, narrowly linear. Frontal feathers laid straight across the base of culmen, descending nearly perpendicularly along the posterior edge of the nasal fossæ, just attaining the posterior end of the nostrils, then retreating obliquely backwards and downwards. Feathers on side of lower mandible extending to a point opposite those on culmen; somewhat further into the interramal space, which is densely feathered. Wings and tail of usual size and shape. Feet small, tarsi moderately compressed, much shorter than the middle toe and without its claw; only two-thirds the middle toe and claw; outer toe as long as, or slightly longer than the middle, its claw much smaller than that of the middle; tip of inner claw just reaching base of middle claw.

Entire upper parts blackish-cinereous, or very dark lead color, deepest and very black on the crown, wings and tail. Entire under parts much lighter and more grayish plumbeous, insensibly blending with the color of the upper parts on the sides of the head, neck, and body, fading very gradually into whitish on the abdomen and under tail coverts. Inner webs of primaries, secondaries and tail feathers dusky gray; the outer glossy black; under surface of wings dusky gray, nearly black along the edge. Bill dusky, tinged with red; tarsi behind and toes below black; rest of feet an undefinable color in the dried state; perhaps reddish in life. "Eyes white and black," (collector's label).

This is a very strongly-marked species, differing to a remarkable degree from any other of the family. The chief peculiarity of form lies in the bill: so small, simple, extremely compressed, destitute of appendages, and otherwise unique, as will be seen by the description, and still more clearly by the diagram. As regards color, the tinge of clear plumbeous which pervades the uniform dark color is very characteristic. There is no trace of a crest, nor of elongated filiform feathers about the head. Their absence, however, is not to be regarded as a specific character, since it cannot be positively affirmed that the specimen is fully adult.

The affinities of the species are clearly with *S. tetraculus*, which it resembles in the small simple compressed bill. But it is unnecessary to compare the two and point out the differences. A glance at the dimensions will alone suffice to show specific distinction. There is no other bird in the family that *S. Cassini* in the least resembles.

SIMORHYNCHUS MICROCEROS, (*Brandt*,) *Coues*.

? *Alca pygmæa*, Gmelin, S. N. i, pt. ii, 1788, p. 555, No. 12; and of the older authors. Based on the Pigmy Auk of Pennant. Not identifiable.
Simorhynchus pygmæus, Schlegel, Urinatores Mus. Pays-Bas, 1867, livr. ix, p. 23. Identifies *A. pygmæa* Gm. as *Phaleris microceros* Brandt or *P. nodirostra* Bonap., and *Uria pusilla* Pall. as young of the same.
Phaleris microceros, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 346.
Phaleris (*Ciceronia*) *microceros*, Cassin, B. N. A. 1858, p. 908.
Ciceronia microceros, Reichenbach.
Phaleris nodirostra, Bonaparte, Comp. and Geog. List, 1838, p. 66. Equals *microceros* Brandt. Audubon, Orn. Biog. v, 1839, p. 101, pl. 402. Audubon, B. Amer. vii, 1844, pl. 468. Gray, Genera Birds, iii, 1849, p. 644.
Ciceronia nodirostris, Bonaparte, Consp. Gav. Comptes Rend., 1856, xlii. p. 774.
"?*Phaleris corniculata*, Eschscholtz," (Gray.) Doubtful citation. Perhaps *Fratercula corniculata*? or *Cerorhina monocerata*?

Asiatic and American coasts of North Pacific; Kamtschatka; Kurile Islands; Plover Bay; Sitka; Japan. Numerous specimens in the Mus. Acad., Philadelphia, and Mus. Smiths. Inst., from various localities. Not known to occur as far south as Washington Territory, U. S., though found in the Japan Sea.

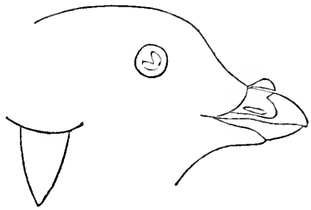

Fig. 11.—*Simorhynchus microceros*, (Brandt). Nat. size.

Smallest of the Auks with the exception of *S. pusillus*. Bill very short, not half as long as the head, stout, deep, wide, little compressed, obtuse at the tip; its width at base nearly equalling its heighth at the same point, and but little less than the length of culmen. A small but conspicuous globular tubercle arising from base of culmen, beyond which the culmen is strongly arched, very regularly convex, rapidly descending, its tip not very acute, obsoletely notched on the tomia, very slightly overhanging the tip of under mandible. Commissure almost straight its whole length, the extremity very slightly ascending. Gonys short, rapidly ascending, very slightly convex. Nostrils in a short but wide and deep fossa, placed rather higher up above the commissure than in some species; narrowly linear, not reached by the frontal feathers. Frontal feathers extending to the node on the culmen, then retreating obliquely backwards as they descend along the sides of the upper mandible; feathers on side of lower mandible extending farther than on upper mandible. Proportions of wings, tail, legs and feet as in other species of the genus.

Adult.—Forehead and lores conspicuously marked with delicate hair lines of white, produced by numerous short, stiff, but very slender white setaceous feathers scattered thickly thereover; a few of which filaments, more elongated and thread-like than the frontal ones, stretch adown the sides of the head to below the level of the jaw; and a few more excessively delicate ones reach from the posterior canthus of the eye some distance along the sides of the occiput and nape. Entire upper parts, including the forehead, vertex, occiput, and sides of head, (with the exception of the white feathers just described) sides of neck, and wings and tail, glossy black. Inner webs of the primaries dusky gray. Under wing coverts, (except the smallest row just along the antibrachium and metacarpus,) white. Region about base of under mandible blackish plumbeous, and a few feathers along the sides under the wings and on the flanks blackish; all other under parts white, mottled, especially on the breast and sides, with black, the throat alone remaining immaculate. Bill red, tubercle and base of upper mandible dark bluish. Legs and feet an undefinable dusky in the dried state; the anterior border of the tarsus, and superior aspect of the toes dull greenish.

Length about 6·50; wing from carpus 3·75; tail 1·25; tarsus ·70; middle toe and claw 1·00; outer do. the same; inner do. ·85; bill: chord of culmen, (including width of knob) ·40; along rictus ·60; gonys ·25; height at base ·30; width at base slightly less.

The preceding is a description of the perfect plumage of this species, which is of comparatively unfrequent occurrence. The usual state of plumage of the bird as met with in collections is much as follows:—Bill as described above; filamentous feathers much as above described, but rather shorter and more sparse, and scarcely appearing behind the eye and along edge of side of lower jaw. Upper parts plumbeous black, sometimes slightly interrupted in its continuity by a few whitish feathers about the scapulars; the primaries grayish black, paler on their inner webs; secondaries grayish white at their tips. Under parts white, as before, but very sparsely marbled or waved with dusky; least so on the abdomen, most so on the sides and breast, where the blackish so increases in amount as to appear more or less continuous with that of the upper parts. Chin and sides of jaw as above described, but throat white, immaculate The dusky mottling varies greatly in amount and in intensity with different specimens. Sometimes it is reduced to a few isolated touches here and there, and again it is found to give the prevailing color to the under parts. That specimens in this mottled condition are not immature, is proven by the fact that the bill is fully grown and provided with a well developed tubercle; and that the forehead is thickly covered with white setaceous feathers. The mottling, however, is confined to the tips of the individual feathers, whose bases are pure white; and is thus *apparently* of a temporary and transient character, like that so frequently met with in young or winter specimens of gulls and petrels. It may be a seasonal feature, or one only found in birds of a certain age; and yet numerous facts tend to indicate it as a character of perfectly mature birds. Were one to examine a specimen with the usual moderate amount of mottling on the under parts, and notice the fact that the blackish occupies only the tips of the feathers, he could not fail to be impressed with the analogy just now hinted at, and to conclude that with advancing age the mottling would grow less and less, and finally disappear, leaving the under parts pure white, as in *pusillus*. Such, however, appears not to be the case. Specimens whose age is attested by a fully developed bill and well formed tubercle, are those most mottled below with blackish. And yet, no specimens have been found with the breast or any other part of the under parts uninterruptedly black, trenchantly divided from white areas. The peculiar kind of mottling exhibited by this species is so unusual as a condition of perfect maturity, that the suspicion arises that the very highest state of plumage is not yet known.

Young.—Entirely similar in plumage to the bird as just described; but the under parts white, scarcely relieved by mottling; and the white extending far around on the sides of the neck, leaving only a narrow median dorsal line black; the bill smaller than that of the adult, and the tubercle wholly wanting, or very imperfectly developed; its place on the culmen being occupied by a soft skinny covering like that on the nasal fossæ.

Specimens frequently occur in this condition. An understanding of its precise import is somewhat complicated by the fact that, although the tubercle is entirely wanting, and the bill otherwise obviously undeveloped, the head is well provided with the whitish setaceous feathers. Birds in such condition might be confounded, on casual inspection, with *S. pusillus*. But more careful examination will result in the observation, that the bill is far too large, *thick*, and heavy to be that of *pusillus*; that there is no conspicuous white patch on the scapulars; that the size of the whole bird exceeds that of *pusillus*: which points, in connection with some others which might be enumerated, will serve to distinguish the two species. Their relationships are dwelt upon more at length in the succeeding article.

When old birds of this species are moulting, in the fall, the glossy black of the fresh feathers on the back is interrupted with dull grayish black patches, formed by the old feathers which have not yet been renewed; and the old worn primaries and secondaries are dull grayish, fading almost into grayish white at their tips and along their edges. A specimen in such a condition, (No. 46,563, Smiths. Mus.) though palpably an old bird, has no trace of a caruncle on the bill.

It may not, perhaps, be exceeding due bounds, to hint at the possibility that the nodule on the bill may be temporary in character, assumed after a certain age, at a certain season, and then lost, wholly or in part, by absorption, to be again resumed at the same period of the following year, probably during the season of reproduction. This suggestion presents itself to the observer without straining on his part, and, in fact, is rather forced upon his attention, after examination of specimens, apparently adult, in which no trace of the tubercle is to be found. The tubercle is in essential characteristics an extrinsic formation upon the bill, differing radically in its structure from the rest of the organ. No good reason appears to forbid the supposition that its growth and subsequent re-absorption, may be periodical. Arguments for such a belief might readily be adduced in the periodical hypertrophy and atrophy of the combs, wattles, caruncles, and the various other fleshy or cutaneous or semi-corneous growths about the head and bill of very many birds, which enlarge during the breeding season, and afterwards diminish or entirely disappear. It is also within the limits of possibility that caruncles of this species is a sexual characteristic. The specimen above mentioned, (No. 46,563,) is marked female. However close to, or remote from, the truth either or both of the foregoing suggestions may be, it is certain that observed facts relating to the rostral knob of this bird are at variance with generally received doctrines about it, and are explicable by the application of one or the other of the preceding hypotheses. At present we are very much in the dark in the matter.

Various ages, conditions of plumage and bill, of this species are well represented by the numerous specimens in the Museum of the Philadelphia Academy and of the Smithsonian Institution, from various localities along the coasts and among the islands of the North Pacific. No specimens are contained in any other American collection.

The only questions of synonymy which arise in this case are connected with the identification of *Alca pygmæa*, Gm., and are treated of under head of *S. pusillus*. Prof. Brandt's name has priority over that of the Prince Bonaparte, although the latter has come into more general employ than the former.

SIMORHYNCHUS PUSILLUS, (*Pallas*) *Coues*.

? *Alca pygmæa*, Gmelin. S. N. i, pt. ii, 1788, p. 555, No. 12; "rostro nigro, vertice, cervice, dorso, alis, caudâ pedibusque obscuris, jugulo et pectore glaucis, abdomine sordide albo. * * alce minor, 7 poll. longa," etc.—Based upon Pigmy Auk, Pennant, Arct. Zool. ii, p. 513, No. 431.

Habitat between Northern Asia and America. Latham, Ind. Orn. ii, 1790, p. 790, No. ii. Same as Gmelin's species. Bonnaterre, Encv. Method. Orn. 1790, p. 33. Same as Gmelin's species. Donndorff, Beytr. Zool. ii, pt. i, p. 825. Quotes Pennant and Latham.

? *Phaleris pygmæa*, Stephens, Shaws Gen. Zool. xiii, 1825, p. 48. Same as *Alca pygmæa*, Gm. Lath.

Phaleris pygmæa, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 347. Quotes both *Alca pygmæa* Gm. and *Uria pusilla* Pall., which he considers as synonymous. Gray, Genera Birds iii, 1849, p. 638. Quotes *Uria pusilla*, Pall.

Tylorhamphus pygmæas, Bonaparte Consp. Gav. Comptes Rendus, 1856, xlii. p. 774. Same as *pusilla*, Pall.

Uria pusilla, Pallas, Zoog. R.-A. ii, 1811, p. 373, pl. 70, haud dubiè. "Fronte brachiisque albo-notatis."

Phaleris pusilla, Cassin, Pr. A. N. S. Phila. 1862, p. 324. Elliot, B. N. Am. 1867, part vi.

Phaleris (*Ciceronia*) *pusilla*, Cassin, Baird's B. N. A. 1868, p. 909.

Asiatic and American coasts of the North Pacific. Kamtschatka, (Pallas.) Semiavine Straits (Mus. Smiths. Inst.) N. W. coast of America (Mus. Smiths. Inst.) Sitka, Russian Amer. (Mus. Pays-Bas, teste Schlegel)

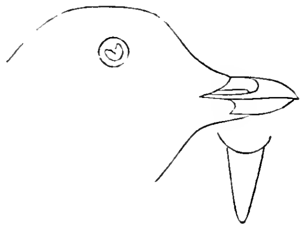

Fig. 12.—*Simorhynchus pusillus*, (Pallas.) Nat. size.

In *size* the least of its genus, and the smallest known natatorial bird. Length, (approximately correct) 5·50 inches; extent of wings ——, wing from carpus to end of first primary 3·50; tail 1·10; tarsus ·75, middle toe and claw 1·10; outer toe and claw 1·00; inner toe and claw ·85; bill along culmen ·40; along rictus, ·65; along gonys ·30; height at base ·20; width at same point the same or slightly less. (Compare these measurements, particularly of the bill, with those of *S. microceros.*)

With the usual *form* of the genus, except as to the bill, the shape of which is specific. Bill without tubercles, or other irregularities of contour; straight, comparatively slender, compressed; height at base much less than length along culmen; width at base the same, or rather less than, height at same point; the apex more acute than that of *microceros:* the outline of culmen at first straight, then slightly convexo-declinate; commissure almost straight, a little ascending anteriorly, still not sinuous in any part of its length; gonys lengthened, at first convex in outline, then rapidly ascending in a straight line. Nasal fossa large, extending along the basal moiety of the bill, reaching from the culmen nearly to the tomia; not deeply excavated; nostrils small, narrow, linear, one eighth of an inch long, basal, lying just above the commissural edge of the upper mandible. Frontal feathers running forward some distance in a rather narrow angle on the culmen, retreating very rapidly obliquely backwards and downwards on the sides of the upper mandible; extending on sides of the lower mandible a little further than on upper. (It is to be gathered from this description, more particularly, that the bill of *pusillus*, compared with that of *microceros*, is fully as long; but slenderer, more acute at the tip, less convex along culmen and gonys, more compressed in its whole extent, and non-tuberculate.)

Adult—Entire under parts pure white; entire upper parts pure black, only relieved as follows: The humeral and scapular feathers are, all of them or most of them, white or whitish in some portion or the whole of their extent; producing two patches of this color, not inaptly comparable to the similar patches on the scapulars of *Brachyrhamphus Wrangeli*, or *Collyrio borealis*, in size, shape and general appearance. About half the secondaries, the innermost ones, are quite conspicuously white on the tips of the outer web for a fourth or a third of an inch. The forehead and lores, from the base of the bill to the eyes and vertex, are lineated (exactly as in *microceros*) with sparse, distinct, very slender white setaceous feathers; none are apparent, among several specimens, behind the eye, or from the commissural angle of the bill. Pallas tersely summed up these points of coloration of the upper parts in saying "Fronte brachiisque albo-notatis;" and the white about the "arms" is a strong distinctive feature of the species in comparison with *microceros*. The white of the under parts reaches far around on the side of the neck; on the side of the head it only extends on a level with the commissure; it does not quite attain the base of the lower mandible, being cut off from the bill by a small blackish-lead-colored area. There are indication of a small whitish spot just above and below the eye, formed of feathers of the ordinary texture. The under wing coverts are wholly white, except just along the edge of the forearm. The short tibial feathers are dusky gray. Bill black, (as nearly as can be determined from the dried specimens,) the base, gonys and tip of lower mandible yellowish. Posterior aspect of tarsus, and inferior surface of toes and webs, blackish; rest of legs and feet a dull undefinable greenish-dusky (in the dried specimens.)

The changes of plumage of this species are not known; no other condition than the one above described is represented by the specimens in the Smithsonian Institution, and none are contained, as far as known, in any other American museum. No. 21,320 of the Smithsonian collection, obtained from Capt. John Rodgers' expedition to the North Pacific, collected at Semiavine Straits by Dr. Wm. Stimpson, is the one above described. No. 21,321, from the same locality, is a younger bird, but entirely similar to 21,320, except that it has a rather weaker bill, and only slight traces of the white setaceous feathers on the forehead. No. 46,562, collected Sept. 9th, 1866, at Plover Bay, by W. H. Dall, of the Western Union Company's Overland International Telegraph Expedition, a young bird, as shown by the soft feel of the feathers and other features needless to detail, is referrible, with some degree of doubt, to this species. The scapulars are very conspicuously white; the secondaries plainly tipped with white; the under parts pure white, unspotted as in typical *pusillus*. The black of the upper parts is tinted, especially about the head, with gray or plumbeous, and there are no traces of whitish setaceous feathers on the forehead; both of which features are to be attributed to the juvenility of the specimen. The doubt in the case centres in the bill. This organ has no trace of a tubercle, and is very small and weak, as usual in the young *pusillus;* but it *seems to be* deeper, and especially wider at the base, compared with its length, than is the case with typical *pusillus;* in these points of shape approximating to *microceros*. But "seems to be" is the most definite expression to be used in this case, for in the preparation of the specimen, or its subsequent drying or packing for transportation, the bill has been injured, and so much distorted, that its true form cannot now be determined with desirable precision.

It cannot be denied that the relations that this species bears to *microceros* are extremely intimate. So closely, in fact, does it approach the latter, that its specific validity might fairly be called in question by one of conservative views; especially in consideration of the well-known fact, not to be disputed, that the bills of all young *Alcidæ* are much smaller and weaker, and even in more striking points of form, conspicuously different from those of adult birds; and that a long time is required for their perfect development. This remark applies with especial force to the formation of the various knobs, ridges, sulci, rictal callosities, and the other irregularities of surface. The mere presence or absence, therefore, of the node upon the base of the culmen, cannot be allowed to constitute a specific character in the present case, and may be left out of consideration, as may be, also, the color of the bill. Too much stress should not be laid upon the presence of white scapulars and of white tips to the secondaries, since in some specimens of undoubted *microceros* unmistakable traces of the former are to be found, and the ends of the inner secondaries are decidedly lighter than the body of the feathers. All the observable differences in the quantity and distribution of the whitish setaceous feathers upon the forehead and other parts of the head might readily enough depend upon a difference in the age of specimens. The pure uninterrupted white of the under parts of *pusillus* stands in apparently strong contradistinction to the black mottling of the same parts of *microcerus*; but it is to be remembered that the coloration in this respect of the latter species is very variable, ranging from a very sparse and scanty marbling to a nearly uniform black, particularly upon the breast, and is therefore not to be too implicitly relied upon, at least until it is more definitely ascertained than at present whether the black mottling tends to decrease or to increase with advancing age. If *microceros* grows more and more marbled with black as it grows older, we might with entire propriety presume upon the existence of a youthful state of plumage, in which the under parts are entirely white, like those of *pusillus*. Such is very likely the real state of the case; for the youngest examples of *microceros* examined—those which have no trace of a tubercle—are nearly white below, only very sparsely and indistinctly mottled with blackish. Still, aside from all these varying and therefore uncertain points, there appear good grounds for separating the two species, as will be observed on comparing the descriptions given in this and in the preceding article.

As the case stands with our present information upon the subject, *P. pusillus* is to be separated from *P. microceros:* first, by certain differences positively known to occur: *a*, in size, which is decidedly less, as evidenced by the measurement of all its dimensions; *b*, in form of bill, which is slenderer, more acute at the tip, not so deep at the base, particularly not so wide at the base, yet not shorter, than that of *microceros;* secondly, by certain differences very constantly observed, yet not proven to always hold good: *a*, absence of tubercle; *b*, conspicuously white scapulars and tips of secondaries; *c*, pure white under parts, uninterrupted by blackish mottling, and extending around on the sides of the neck; *d*, shortness and scantiness of the white setaceous feathers on the forehead; *e*, color of bill, mostly black, not mostly red.

It only remains to notice the synonymy of this species, and all that is to be said on this score relates to the identification of *Alca pygmæa* Gm. This name is founded upon the "Pigmy Auk" of Pennant,—a small species first described very loosely and imperfectly by the latter writer, whose account Gmelin merely renders into Latin, in applying a binomial name. There is no doubt that the bird was one of the little Auks of the North Pacific, as its very name, and the dimensions assigned (seven inches), clearly indicate, but there is no possibility, at the present day, of identifying it with precision. It was very possibly based either upon the present species or the preceding (*microceros*), and should these two ever be united, as young and old of the same, the name *pygmæa* might without undue violence be assigned to the species so constituted. So long as they are regarded as distinct, the name *pygmæus* must not be applied to either of them. As far as we can judge by the description, particularly the expression "jugulo et pectore glaucis," *pygmæa* may not impossibly have been based upon *Ptychoramphus aleuticus*. But Mr. Cassin's supposition is perhaps as near the truth as any that could be advanced: "It is possible that the Pigmy Auk of Pennant, which is *Alca pygmæa* Gmelin, may be the young of this species [*microceros*], but it is more probable, judging from the descriptions of Gmelin and Latham, that several small species have been confounded under this name." The same gentleman also calls attention to the fact, that some of the expressions in the diagnoses of the old authors have no basis in the characters of any Alcidine bird. Under the circumstances, it behooves us to ignore the name *pygmæa* altogether, since it cannot be identified; and to accept *pusillus* of Pallas, to which no possibility of doubt attaches, as the proper name of the present species.

PTYCHORHAMPHUS, *Brandt.*

Uria, Pallas, Zoog. R.-A. 1811, ii, p. 370, in part; not of authors.
Ptychorhamphus, Brandt, Bull. Acad. Sc. St. Petersb. ii, 1837, p. 347. Type *Uria aleutica*, Pall.
Mergulus, Gambel, Pr. A. N. S. ii, 1842, p. 266, in part; not of Ray, Vieill.
Arctica, Gray, Genera, iii, 1849, p. 638; in part; not of Mœhring.
Simorhynchus, Schlegel, Mus. Pays-Bas, 1867, livr. ix, p. 26, in part; not of Merrem.

Size moderate; general form stout; not crested, nor with any elongated feathers about the head. Bill about two thirds as long as the head, three-fourths as long as the tarsus, very stout, straight, somewhat conical in shape, slightly if at all compressed, without nodes or irregularities, the tip acute; culmen very moderately declinato-convex in outline, the ridge broad, more or less corrugated transversely at the base; the sides of upper mandible bulging, the tomial edges inflected; sides of lower mandible nearly upright, flat, longitudinally grooved for the greater part of their length, their tomial edges somewhat inflected; rictus straight; gonys straight, or nearly so, very long. Nasal fossæ long and wide, shallow, filled in with soft skin; that of the two fossæ meeting over the base of the culmen, and there corrugated as just described; nostrils rather long, narrowly oval, subbasal, opening at the lower border of the fossæ, the edge of the membrane that overhangs them elevated, flaring. Frontal feathers in a nearly transverse line across the base of the culmen, thence descending a little obliquely backwards, just behind the nostrils, to the commissure; those on lower mandible extending, in the interramal space (which they completely fill), to a point rather beyond a perpendicular from those on culmen; then, encroaching very little on the sides of the lower mandible, they retreat in a straight line rapidly backwards and obliquely upwards. Wings moderately long, narrow, pointed, the primaries somewhat falcate, narrowing rapidly at the tip to an acute point, first longest, rest equably graduated. Tail short, broad, rounded, contained about three and a half times in the length of wing from the carpal joint; the feathers broadly rounded at their tips. Tarsus much shorter than the middle toe without its claw; about two-thirds as long as the middle toe and claw; greatly compressed, covered with small, very irregularly shaped polygonal reticulations; no large transverse scutellæ. Outer lateral toe as long as, or slightly shorter than the middle; its claw not reaching the tip of the middle claw. Tip of inner claw reaching base of middle one. Claws compressed, acute, moderately arched, the inner edge of the middle one dilated.

This genus was instituted in 1837 by Prof. Brandt, for the reception of the *Uria aleutica* of Pallas, its type and only species. It is strongly characterized by the bill, which is of a shape not even approximating towards that of any other Alcidine bird. Its points of structure in other respects are shared by the majority of the family.

PTYCHORHAMPHUS ALEUTICUS, (*Pall*) *Brandt.*

Uria aleutica, Pallas, Zoog. R.-A. ii, 1811, p. 370. "Corpore suprà fusco, subtus albo liturato, rostro producto, triplici plica inter nares."
Ptychorhamphus aleuticus, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 347. Bonaparte, Tabl. Comp. Pelag. Compt. Rend., 1856, xlii, p. 774. Cassin, Baird's B. N. A. 1858, p. 910. Heermann, Pac. R. R. Rep. x, 1859, Route to Cala. Birds, p. 75. Elliot, B. N. Am. part iv, 1867.
Phaleris aleutica, Gray, Genera Birds, iii, 1849, p. 638.

Simorhynchus aleuticus, Schlegel, Urinatores Mus. Pays-Bas, ix livr. 1867, p. 26.
Mergulus Cassinii, Gambel, Pr. A. N. S. Philada. ii, 1845, p. 266. Id., Journ. A. N. S. Phila. 2d series, ii, 1850, pl. vi.
Arctica Cassinii, Gray, Gen. Birds, iii, 1849, p. 638.

Pacific coast of North America, south to San Diego, California. Breeds on the Farralone Islands. Aleutian Islands (Pallas), Russian America, and whole west coast of the United States. (Mus. Smiths. Inst. and Acad. Philada.)

Adult.—Bill black, base of lower mandible whitish or yellowish. Legs anteriorly, and toes superiorly bluish; legs posteriorly, and toes inferiorly, with the membranes, blackish. A slight touch of white about the eyes. Entire upper parts blackish-plumbeous, the head, wings and tail nearly black. This color, gradually diluted until it is much more grayish-plumbeous, extends around the under parts and sides of the head, the throat, upper part of the breast, and whole sides of the body under the wings. Greater part of breast, with abdomen and under tail coverts pure white; the grayish plumbeous of the upper breast merging very gradually into the white of the belly. Under surface of wings dark lustrous gray.

Young.—Very similar to the adult; differing chiefly in being more decidedly blackish on the upper parts.

Moulting specimens have the upper parts much duller and grayer, the old wing and tail feathers faded, especially towards their tips, into light brownish-gray.

Length 8·00 to 9·50; extent 16·00 to 18·50; wing 4·75 to 5·25; tail 1·50 to 1 75; tarsus about 1·00; middle toe and claw 1·40; outer do. 1·30; inner do. 1·10; culmen ·75; rictus ·90; gonys ·60; depth of bill opposite posterior extremity of nostrils ·40; width ·30.

As regards color, this species is remarkably constant. Hardly any other differences than those first noticed are to be found, after examination of extensive series; and they may all be summed up as merely varying shades of the same color, and slight variation in its extent downwards upon the breast. The bill at all ages and seasons presents its peculiar parti-coloration. These remarks, however, probably do not apply to fledgelings. As regards size, the species is perhaps unusually variable, as may be seen by the measurements given above, which represent extremes in those cases where two sets of figures are given, and the average in other measurements. The bill, in particular, is liable to great variation both in length and in stoutness. Some bills are very large and robust, nearly as wide as high at the base, rather obtuse at the tip, and with decidedly curved culmen and gonys; others are longer in proportion to their transverse dimensions, decidedly compressed throughout, acutely pointed, with almost straight culmen and gonys. The corrugations about the base of the upper mandible are sometimes nearly obsolete, and when present are very variable in character. Very likely they are hardly, if at all, apparent in life; for they seem to be produced mainly by the shrinking in drying of the skin covering the nasal fossæ and base of the culmen. All the variations exhibited by the numerous specimens seem to be merely individual differences, and are not sufficient to excite a suspicion that more than one species is represented in the series.

Mergulus Cassinii Gambel (*Arctica Cassinii* Gray) is now well known to be this species, first described by Pallas, as above quoted The species has no other synonyms of consequence. Its striking peculiarities suffice to prevent misconception regarding it.

Subfamily Urinæ.

MERGULUS, (*Ray*) *Vieill.*

Mergulus, Ray, Syn. Av. Vieillot, Analyse, 1816, and of authors. Type *Alca alle*, Linn.

Plautus, Klein, Prod. Av. p. 140. In part.
Arctica, Mœhring, Av Gen. 1752, p. 65. Type *Plautus columbarius*, Klein, Gray, Genera, iii, 1849, p. 644. Type *Alca alle*, Linn.
Alca, Linnæus, S. N., i, 1758. In part.
Uria, Pallas, Zoog. R. A. 1811, ii. In part.

Bill very short, culmen only three-fourths the tarsus, very stout, scarcely compressed, obtuse at the tip, as wide as high at the base, the sides of both mandibles convex or vaulted, the tomial edge of the upper greatly inflected, the culmen very convex in outline, with a broad flattened ridge, the rictus ample, much decurved towards the end, the gonys straight, very short, the inferior mandibular rami correspondingly elongated, widely divaricating, the interramal space very broad, the nasal fossæ short, wide, deep, partially feathered. Nostrils subbasal, short, more broadly oval, or more nearly circular than in any other genus except *Synthliborhamphus*. Wings rather longer than usual in this family, acutely pointed. Tail of ordinary length, much rounded, the feathers rather narrow and subacuminate at tip. Feet small and weak; tarsus scarcely compressed, anteriorly broadly scutellate, posteriorly finely reticulate. Toes of the usual proportionate lengths. Size very small; general form very compact, stout.

A peculiar genus of the *Alcidæ*, the most essential characters of which, as usual in this family, are found in the bill, though the other members offer some appreciable, if not salient features. The squat bunchy shape of the single species is very noticeable.

This is the genus through which a certain type of structure found among the Longipennes inosculates with the Pygopodes. The relationship of *Pelecanoides urinatrix* to *Mergulus alle* is one of strong analogy, if not of actual affinity, as has been elsewhere already pointed out by the writer.* Aside from the obviously Procellaridian characters of the bill, *Pelecanoides* (representing the subfamily *Halodrominæ*) is strictly a Pygopodous genus, and is very nearly identical with *Mergulus* in all the details of external structure, and has much the same general habitus. It is certainly the connecting link between the macropterous and brachypterous natatores, holding so strangely anomalous a position betwixt the two, that it cannot be with much propriety included under either. It seems entitled to the rank of a family, to take place between the *Procellariidæ* and *Alcidæ*.

MERGULUS ALLE, (*Ray*) *Vieill.*

Mergulus melanoleucus, Ray, Syn. Av. p. 125. Stephens, Shaw's Gen. Zool. xiii, 1825, p. 345. Brandt, Bull. Acad. St.-Petersb. ii, 1837, p. 347. Brewer, oct. ed. Wilson's Orn., with notes by Jardine, 1840, p. 658, fig. 315. Fleming, Hist. Brit. Anim. 1842, p. 135. Thompson, Nat. Hist. Ireland, iii, 1851, p. 218.
Columba grœnlandica, "Albanus, Av. p. 81, pl. 85. Gunn., Act. Nidroff, i, p. 206, pl. 6."
Plautus columbarius, Klein, Prod. Av. p. 146, No. 1.
Alca alle, Linnæus, S. N. ed. x, i, 1758, p. 131, No. 6. Id. ibid. ed. xii, 1766, i, p. 211, No. 5. Brünnich, Orn. Bor. 1764, p. 26, No. 106. Hermann, Tab. Affin. Anim. p. 149. Müller, Zool. dan. Prodr. p. 17, No. 142. Latham, Ind. Orn. ii, 1790, p. 795, No. 10. Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 823, No. 5.—Donndorff's Var. B is *candida* Lath.—Wilson, Am. Orn. ix, pl. 74, fig. 5. Schlegel, Urinatores Mus. Pays-Bas, ix livr. 1867, p. 20.
Uria alle, Pallas, Zoog. R.-A. ii, 1811, p. 369. Temminck, Man. Orn. ii, 1820, p. 928. Bonaparte, Obs. Wils. 1826, No. 238. Audubon, Orn. Biog. v, 1838, p. 304, pl. 339.
Uria (*Mergulus*) *alle*, Bonaparte, Synopsis, 1828, p. 425.

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* *Cf.* Pr. A. N. S. Philada. May, 1866, pp. 172, 189.

Mergulus alle, Vieillot, Analyse, 1816, p. 66. Id., Gal. Ois. 1825, p. 236, pl. 295. Gould, Birds Eur. v, 1837, pl. 402. Macgillivray, Hist. Brit. Birds, ii, 1852, p. 341. Bonaparte, Comptes Rendus, 1856, xlii, p. 774. Cassin, Baird's B. N. A. 1858, p. 918. Boardman, Pr. Bost. Soc. N. H. Sept. 1862, p. 131. Verrill, Proc. Essex Inst. iii, 1863, p. 160. Samuels, Ornith. and Ool. of New England, 1867, p. 570.

Arctica alle, Gray, Gen. Birds, iii, 1849, p. 644.

Alca alce, Gmelin, S. N. i, pt. ii, 1788, p 544, No. 5.

Alca candida, Brünnich, Orn. Bor. 1764, p. 26, No. 107. In pure white plumage; probably albino.

Mergulus arcticus, Brehm

E ropean and American coasts of the North Atlantic. On the United States coast, in winter, south to New Jersey. Numerous specimens in Mus. Acad. Philada., Smiths. Inst., Bost. Soc. Nat. Hist., Essex Inst., Cab. G. N. Lawrence, author's Cab., etc.

Adult, summer plumage.—Head and neck all around, and entire upper parts glossy black, with a beautiful metallic lustre of a shade of blue, when in highest plumage; scapulars edged with white; shafts and inner webs of primaries brown, lighter at base; secondaries tipped with white; under surfaces of the wings brownish-gray; under parts from the breast pure white, with a few elongated feathers of the sides and flanks varied with black on the outer webs; bill black; legs and feet posteriorly blackish, anteriorly flesh-colored (dull yellowish in the dried state).

Adult in winter.—As before; the white of the under parts extending on the neck and throat to the bill, on the sides of the head to the level of the rictus, on the sides of the nape over the auriculars (where it is somewhat marbled with black), or even to the middle of the nape, more or less confluent with that of the other side

Young, first winter.—Recognizable by its smaller and weaker bill, by the duller and more brownish black of the upper parts, almost wanting in gloss, and by the greater extension of the white upon the sides of the hind head and neck. The scapulars and coverts are conspicuously marked with white, as in the adult. The feet are mostly dusky.

Length 8·50; wing 4·75; tail 1·50; tarsus ·80; middle toe and claw 1·20, outer do. 1·15, inner do. ·85; bill along culmen ·50, rictus 1·00, gonys ·20; its depth at base ·35, its width at same point about the same.

When in mature plumage, this is a very beautiful species. No other Alcidine has such lustre of the dorsal plumage, traces of which are even found in adult winter specimens. In the latter the extent of the black upon the throat is indicated by a dusky clouding of the bases of the feathers of the parts. The species is ordinarily subject to only moderate variation in size or colors. The condition of albinism has been described.

The first chronicles of this species are of great antiquity. It appears to have shared for a time with *Uria grylle* the soubriquet of "Columba grœnlandica." Since its description as *Alca alle* by Linnæus, it has been the basis of very few synonyms. *Alca candida* of Brünnich is this species in the albino state. *Mergulus melanoleucus*, Ray, is adopted by many authors. Mr. G. R. Gray adopts Mœhring's generic appellation.

SYNTHLIBORHAMPHUS, *Brandt.*

Alca, Gmelin, S. N. i, 1788, p. 554, and of the older authors, in part.

Uria, Pallas, Zoog. R -A. ii, 1811, and of some authors, in part.

Fratercula, Stephens, Shaw's Gen. Zool. xiii, 1825, in part.

Synthliborhamphus, Brandt, Bull Acad. St. Petersb. ii, 1837. (Type *Alca antiqua*, Gm.) Subgenus of *Brachyrhamphus*, Brandt.

Mergulus, Vigors, Zool. Voy. Blossom, 1839, in part.

Arctica, Gray, Genera, iii, 1849, in part.
Anobapton, Bonaparte, Comptes Rendus, 1856, xlii. p. 774, in part.

Size moderate or rather small; general form stout, compact; head with or without a crest: bill somewhat as in *Brachyrhamphus*, but much stouter, and shorter for its depth: much compressed throughout, depth at base about half the length of culmen, culmen and gonys moderately curved, gonys straight, ascending: nasal fossæ small and shallow; nostrils subbasal, broadly oval or nearly circular, as in *Mergulus*, feathered; feathers extending to about the same distance on culmen and keel; on both mandibles retreating rapidly backwards from the point of their furthest extension: those on the upper passing just by the nostrils, but not covering the latter. Wings of usual size and shape in this group; secondaries very short, as in *Brachyrhamphus*, the tip of the longest not reaching much more than half-way from the carpal joint to the end of the first primary in the closed wing. Tail of usual length, short, broad, nearly square, or very slightly rounded, the feathers very broadly rounded at tip. Tarsi much compressed, anteriorly and laterally transversely scutellate, posteriorly reticulate; about as long as the middle toe without its claw. Outer toe as long as or rather longer than the middle; its claw smaller than that of the middle; tip of inner claw reaching base of middle. Claws small, short, compressed, moderately curved and acute, the inner edge of the middle one somewhat dilated.

With the general appearance of *Brachyrhamphus*, this genus differs from the latter in the bill and feet. The bill is deeper at the base, and more compressed throughout; the feet are still more different, having very broad transverse scutellation on the anterior face of the tarsus, instead of polygonal reticulation; and are larger, both relatively and absolutely, with longer, much more compressed tarsi than in *Brachyrhamphus*. The type of the genus is the old *Alca antiqua* Gm. A second species occurs, which differs from the type, as far as form is concerned, in a slenderer bill, and in the presence of a conspicuous crest.

Species.—(2.)

Not crested; bill stout, depth at base more than half the length of culmen; white on sides of vertex not extending in advance of the eyes........ .... *antiquus.*

Crested; bill slender, depth at base about equal to half the length of culmen; white on sides of vertex extending along sides of forehead nearly to the bill.. .... *wurmizusume.*

SYNTHLIBORHAMPHUS ANTIQUUS, (*Gmel.*) *Brandt.*

Alca antiqua, Gmelin, S. N. i, pt. ii, 1788, p. 554, No. 11. Based upon Antient Auk, Pennant, Arct. Zool. 1785, ii, p. 512, No. 430. Latham, Ind. Orn. ii, 1790, p. 795, No. 9. Donndorff, Beytr. Zool. ii. pt. i, 1794, p. 824. Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 21.
Fratercula antiqua, Stephens, Shaw's Gen. Zool. xiii, 1825, p. 42.
Uria antiqua, Temminck and Schlegel, Fn. Japon. 1845, pl. 80. Audubon, Orn. Biogr. v, 1839, p. 100, pl. 402, fig. 12. Id. B. Amer. vii, 1844.
Brachyrhamphus (*Synthliborhamphus*) *antiquus*, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 347. Cassin, Baird's B. N. A. 1858, p. 916.
Brachyrhamphus antiquus, Gray, Gen. Birds, iii, 1849, p. 644.
Anobapton (*Synthliborhamphus*) *antiquus*, Bonaparte, Consp. Gav. Comptes Rendus, 1856, xlii. p. 774.
Uria senicula, Pallas, Zoog. R.-A. ii, 1811, p. 369, pl. 85.
Mergulus cirrhocephalus, Vigors, Zool, Voy. Blossom, 1839, Birds, p. 32.
Arctica cirrhocephala, Gray, Gen. Birds, iii. 1849, p. 644.

American and Asiatic Coasts of the North Pacific. Kamtschatka, Japan Seas. Sitka, Russian America, (Mus. Smiths. Inst.) Mus. Acad. Philada.

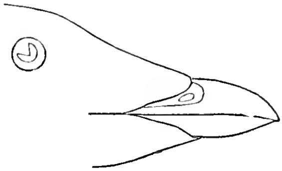

Fig. 13.—*Synthliborhamphus antiquus*, (Gmel.) Nat. size.

With the form, etc., typical of the genus, as above described.

Adult, high breeding plumage, (No. 46558, Mus. Smiths. Sitka, R. A.) Bill whitish, or yellowish, culmen and base of both mandibles abruptly black; legs and feet anteriorly apparently whitish, or yellowish; posteriorly, with both surfaces of the webs, black. Head all around, and throat, black; pure and intense above, on the sides below, chin and throat, tinged with fuliginous brown. A conspicuous stripe of pure white beginning over each eye, and extending backwards over the sides of the occiput, connected across the nape by some white feathers, and spreading on the sides and back of the neck, as a large disconnected series of trenchantly defined white streaks. Trace of white on each eyelid. Entire upper parts clear dark plumbeous, blackening on the upper tail coverts and tail. Upper surface of wings the same, or rather darker, the edge of the wing all along from the elbow, and the exposed parts of primaries, blackish; entire under surface of wings white, except just along the edges where it is mottled with dusky; the basal portion of the inner webs and shafts of primaries whitish; secondaries like the wing coverts, or rather darker, their bases whitish. Sides of the body under the wings pure velvety black, in marked contrast to the clear plumbeous of the upper parts and white of the lower. These black feathers are posteriorly greatly elongated, reaching quite to the tail, and overlying the sides of the rump and the flanks, which latter, however, are seen to be pure white on raising the elongated supercumbent feathers. This black along the sides extends anteriorly in front of the wings, and, still strongly contrasted with the plumbeous of the interscapulars, continues on as a band quite to the nape, which it crosses to become confluent with its fellow of the opposite side. On the sides of the neck it is thickly marked with the pure white streaks already described. The fuliginous black of the chin and throat is continuous with that of the sides of the head as far as the auriculars; further on it merely extends as a point along the middle of the throat, being separated from the black of the sides of the nape by a large white area, an extension to the auriculars of the white which is the color of the whole under parts except the sides under the wings, as already described.

Length 9·50 to 10·50; extent 16·75 to 18·25; wing 5·50; tail 1·60; bill along culmen ·60, along rictus 1·20, along gonys ·40, depth at base ·30, width ·20; tarsus 1·00; middle toe and claw 1·25, outer do. 1·15, inner do. 1·00.

Younger.—Bill and feet as above described. "Iris brown," (label). Upper parts as in the adult, but darker, the plumbeous being obscured by dusky, especially on the wing and tail coverts, and lower back. Forehead, crown, nape, and back of neck, sooty black, entirely unrelieved by white streaks, or with only traces of the latter on the sides of the occiput. Eyelids sometimes largely white. No black on the throat or chin; traces of it in a dusky mottling about the base ot the bill. White of under parts extending on sides of head below and behind nearly to the eyes, and far around on the sides of the nape, so that only a median nuchal line is left blackish. Sides of body under the wings not pure black, but merely dusky plumbeous, and this not continuous on the feathers over the flanks, these being in some part white, producing a white and plumbeous variegation. The line of this dusky plumbeous hardly extends in front of the wings to the sides of the neck. Under parts white, as before, the bases of the inner webs of the primaries rather more white than in the adult.

The above described differences between the adult and young are very decided, and might suggest a distinction of species, were not various means between the extremes forthcoming. Beyond these variations in plumage the species is very constant in characters, with the exception of the bill. This differs a good deal as to its size and shape ; but nevertheless usually preserves the specific characters which distinguish it from that of *Wurmizusume*. Thus the difference in length between the bills of two perfectly mature examples, absolutely identical in plumage, and in all other respects, save length of bill, amounts to a tenth of an inch along the culmen. This difference being unaccompanied by a corresponding difference in depth and width, gives a readily appreciable difference in shape of the bill.

The only species to which the present bears any special resemblance is *Wurmizusume*. The comparative characters of the latter are dwelt upon at length in the article immediately succeeding.

It is barely possible that two distinct species may be confounded in the synonymy adduced at the head of this article, and that the bird here described is not the veritable *Alca antiqua*, Gm., ("Antient auk" of Pennant.) In the description of these authors the upper parts are said to be dusky or sooty black, whereas, as will be seen by the description, the subject of the present article has these parts clear plumbeous. But we have just seen that the young of the present bird has the upper parts decidedly darker and duller than the adult ; in fact tending, especially upon the wings and lower back, to dusky. The limits within which the species is known to vary in this respect are sufficiently wide to allow its reference to the bird of Pennant, Latham and Gmelin ; especially when it is remembered that the particular descriptive terms used by these authors may not have been critically correct. It seems unnecessary, and it would be, perhaps, unjustifiable to attempt to discriminate the present species from *Alca antiqua*, upon the grounds just mentioned. They had best be regarded as the same, at least until suites of specimens may determine the existence of two species, differing in the particulars above mentioned. No indications of a distinction of species can be found in the extensive series of specimens at present contained in American collections.

This species, in the condition here described as that of the adult, is the *Uria senicula*, Pallas; and should bear the name of *Synthliborhamphus seniculus* in the event of its not proving the same as *Alca antiqua*, Gm. *Mergulus cirrhocephalus*, Vigors, (*Arctica cirrhocephala*, Gray,) is the same bird, in the same condition of maturity. The species has no other synonyms of consequence, except those resulting from its reference to several different genera.

In breeding plumage it is a very handsome bird, being in fact—with the exception of *Wurmizusume*—the handsomest of the *Urinæ*. It is of frequent occurrence along the coast and among the islands of the North Pacific ; extending, on the Asiatic side, to Japan, and on the American, to Washington Territory, U. S. It apparently migrates southward in winter. It breeds in the vicinity of Sitka, R. A. It is well represented by numerous specimens in the collections of the Philadelphia Academy and of the Smithsonian Institution. It has been figured by Temminck and Schlegel, and by Audubon.

Synthliborhamphus Wurmizusume, (*Temm.*) *Coues.*

Uria Wurmizusume, Temminck, Pl. Color, No. 579. Temminck and Schlegel, Fn. Japon, 1845, pl. 79.

Anobapton (*Synthliborhamphus*) *Wurmizusume*, Bonaparte, Tab. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774.

Brachyrhamphus (*Synthliborhamphus*) *Temminckii*, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 347. Cassin, Baird's B. N. A. 1858, p. 916.

Brachyrhamphus Temminckii, Gray, Gen. Birds, iii, 1849, p. 644. Cooper and Suckley, Pac. Rr. Rep. xii. p. ii, 1860, p. 287. Elliot, B. N. Am. part vi, 1867.

Alca Temminckii, Schlegel, Urinat. Mus. Pays-Bas, livr. ix, 1867, p. 22. (Japan.)

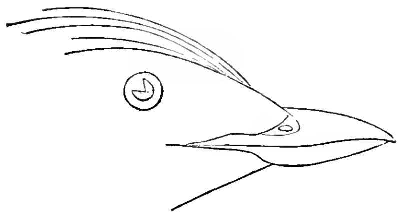

Fig. 14.—*Synthliborhamphus Wurmizusume*, (Temm.) Nat. size.

Asiatic and American Coasts of the North Pacific; south to Japan and Washington Territory, U. S. Specs. in Mus. Acad. Philadelphia, and Mus. Smiths. Inst.

Bill more slender and elongated than in the type of the genus, the depth at base less, and the compression not so great, the sides of the bill being less vertical; rictus nearly straight. Rather larger than *S. antiquus*.

Adult.—Bill decidedly yellow, (in the dried state,) the ridge of upper mandible alone black. Feet dull livid bluish, the webs dusky, (feet dusky yellowish in the dried state) "Eye brilliant gray, iris black" (label). A large conspicuous crest springing from the extreme forehead of a dozen, (more or fewer) slender elongated features, not recurved, but extending straight backwards quite to the occiput. A large conspicuous series of white feathers on each side of the top of the head, extending from the base of the crest, on the forehead far in advance of the eyes, to the side of the nape; there more or less confluent with each other, and then dispersed as isolated white streaks over the sides of the neck to the shoulders. In many specimens, however, apparently quite adult, these white stripes are hardly, if at all, apparent beyond the nape. Rest of head, including chin and upper part of throat sooty or fuscous blackish, sometimes with a cinereous tint; this color extending as far as the interscapular region, from which point the upper parts are more decidedly plumbeous, only the wings and tail being somewhat darker and more fuscous. Sides under the wings plumbeous black quite to the flanks; this color also extending forward in front of the wings and continuous with that of the sides of the neck and head. Under surface of wings pure white, except a little dusky clouding along the edge; bases of primaries, and the greater portion of their inner webs white, deepening very gradually through a continuously deepening shade of brownish gray, into dusky at the tips. Entire under parts (except the sides, as just described) pure white.

Length 10·50 to 11·00; extent 18·00 to 18·50; wing 5·50; tail 1·75; tarsus 1·00; middle toe and claw 1·25, outer 1·20, middle 1·00; bill along culmen ·70, rictus 1·10; gonys ·40; height at base ·25 to ·30, width about the same.

Younger.—Bill and feet as above; (bill sometimes, however, wholly blackish.) Without a crest; no white feathers about head, or only slight traces thereof. Face, including region just about the base of the bill, both above and below, crown and sides of the head to the level of the commissure, with nape and back of neck, plumbeous dusky; other upper parts, particularly the wings, the same, but most of the back with a more decided tint of plumbeous. Under wing coverts and primaries as in the adult. Sides under the wings narrowly fusco-plumbeous, the lengthened feathers over the flanks variegated with white. Entire under parts otherwise white; this color extending far around on the sides of the upper neck, nape and occiput.

Considerable variation in plumage as well as in size, and to a degree, in shape of bill, is exhibited by the numerous specimens examined. The differences in the bill are chiefly those of size, the relative proportions of the various measurements being pretty constantly preserved. The bill is always slenderer, and usually longer than that of *antiquus*, approaching in this respect the bills of the true *Brachyrhamphi*. The size of the whole bird varies somewhat, but not to any remarkable degree. In apparently equally adult specimens, the two series of white feathers, which form conspicuous stripes on the sides of the vertex and nape, vary much in length. Sometimes they spread out on the sides of the hind-neck to almost as great an extent as is witnessed in the most highly plumaged specimens of *antiquus;* again they may stop abruptly on the occiput, or at least on the nape. The comparative amounts of dusky and plumbeous on the upper parts is various, as is also the intensity of either of these hues. Thus a specimen, (No. — Phila. Acad., from Japan,) has the upper parts including the wing coverts bluish ashy, or bluish plumbeous, light enough to form a marked contrast with the band of nearly black which crosses the nuchal region, and descends on either side under the wings. In this specimen, also, the bill is blackish, although it is evidently an adult bird, having a crest an inch long. There is sometimes much white on the eyelids, sometimes none. The outline of the white on the sides of the hind head and of the neck varies; the younger the bird, the more the white encroaches on these parts.

It is not ascertained positively that the crest which so strongly characterizes perfect specimens of this species as a constant feature, that is, obtained at a certain age, and ever afterwards worn. Very possibly, it is only assumed during the breeding season; and falls off afterwards, so that perfectly adult winter specimens may be without it. It is at all events not to be enumerated among the infallible diagnostic points of the species.

Compared with *S. antiquus*, the species is at once distinguished, when in adult breeding plumage, by the presence of a crest, and the different extent of the white stripes and streaks upon the head, nape and neck. (Consult descriptions above given.) These differences aside, it is a larger bird, on an average, though some specimens do not exceed in size some examples of *antiquus*. The bill is slenderer, though not necessarily longer, more acute at the tip, comparatively not so deep at the base, and rather less compressed, the culmen, rictus and gonys straighter. The identification of very young birds, however, is sometimes attended with difficulty; and some specimens in the present collections cannot, in fact, be satisfactorily determined. This state of affairs, however, is by no means unparalleled in other cases of perfectly distinct species; and by no means militates against the belief in the specified distinction of the two birds now under consideration. The adults cannot by any possibility be mistaken for each other.

This species is well represented in all its variety, by numerous specimens in the collections of the Philadelphia Academy and the Smithsonian Institution; though not contained, as far as heard from, in any other American cabinets. It is of frequent occurrence on the coasts of the North Pacific, and appears to be particularly abundant in the vicinity of Japan, whence most of the specimens described or recorded have been obtained. Its occurrence on the coast of the United States is open to question. Several specimens of *S. antiquus* (at least of the bird described in this paper under this name) are in our collections from Washington Territory, labelled "Brachyrhamphus Temminckii," and these appear to represent the species whose habits, etc., are alluded to by Drs. Cooper and Suckley, volume twelve, part ii, of the Pacific Railroad Reports, (Nat. Hist. Wash. Terr. p. 287, above cited) under the name of *Brachyrhamphus Temminckii*. But the description there given is that of the true *Temminckii*, having been copied from Mr. Cassin's article on the "Birds of North America."

The name which heads this article has priority over "Temminckii" of Prof. Brandt, and is therefore to be adopted, though its barbarous character is, assuredly, a matter of regret. It varies in orthography with different writers.

BRACHYRHAMPHUS, *Brandt*.

Colymbus, Gmelin, S. N. i, 1788; in part; not of authors.
Uria, Latham, Ind. Orn. ii, 1790; in part; not of authors.
Cepphus, Pallas, Zool. R. A. ii, 1811, in part.
Brachyrhamphus, Brandt, Bull. Acad. St. Petersburg, ii, 1837. Type *Colymbus marmoratus*, Gm.
Apobapton, Brandt, l. c. Same type.
Anobapton, Bonaparte, Comptes Rendus, xlii, 1856. Same type.

With the general habitus of *Uria* proper, but of much more delicate build, different pattern of coloration, and very small size. Bill small, slender, much shorter than the head, not longer than the tarsus, greatly compressed, acutely tipped; culmen gently curved, its ridge sharp, rictus nearly straight, gonys straight; tomial edge of upper mandible greatly inflected towards the base, notched near the tip. Nasal fossæ small and shallow, nearly filled with feathers, which mostly cover the extremely minute oval nostrils. Wings of ordinary length, very narrow, pointed, falcate, the secondaries extremely short. Tail of ordinary length, almost square, the feathers obtusely rounded. Feet very small, short, slender, and weak; tarsus scarcely compressed, variable in length, never longer than the middle toe without its claw (except in *brachypterus ?*) Outer and middle toes equal in length; the claw of the former much smaller than that of the latter; the inner very short, its claw not reaching the base of the middle claw. Claws small, weak, moderately curved, very acute.

The genus which comprises the Murrelets—to coin an English word, needed for the *Brachyrhamphi*,— is a very natural and strongly marked one. It comes nearest to *Uria* proper, from which, however, it is sufficiently distinguished, as will be seen by the above diagnosis. It contains four or five species, all inhabitants of the North Pacific, and more particularly of the west coast of North America. These may readily be diagnosticated as follows:—

Species :—(5.)

I. Tarsus much shorter than the middle toe without its claw.
  Upper parts blackish and chestnut, lower parts blackish and white.. 1. *marmoratus*.
  Upper parts cinereous and white, lower parts pure white.. .... 2. *Wrangelii*.

II. Tarsus just as long as the middle toe without its claw.
  Under surface of wings white .... 3. *hypoleucus*.
  Under surface of wings dusky........................ .... 4. *Craveri*.

III. Tarsus longer than the middle toe without its claw, (teste Brandt)........................... .... 5. *brachypterus ?*

BRACHYRHAMPHUS MARMORATUS, (*Gm.*) *Brandt*.

Colymbus marmoratus, Gmelin, Syst. Nat. i, 1758, p. 583, No. 12. Based on the marbled guillemot, Pennant,* Arct. Zool. ii, p. 517, pl. 22, and Latham, Syn. vi, p. 336, pl. 96. Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 870.

Uria marmorata, Latham, Ind. Orn. ii, 1790, p. 799. Stephens, Shaw's Gen. Zool. xii, 1824, p. 249. Bonaparte, Synopsis, 1828, p. 423.

Brachyrhamphus (*Apobapton*) *marmoratus*, Brandt, Bull. Acad. St. Petersburg, ii, 1837, p. 346. Cassin, Birds N. A. 1858, p. 915; in part. Description of supposed adult is that of B. Wrangeli.

Brachyrhamphus marmoratus, Gray, Genera Birds, iii, 1849, p. 644. Cooper and Suckley, Nat Hist. Wash. Terr. 1860, p. 286, in part. Not the description of supposed adult, which is that of *B. Wrangeli.*

Anobapton (*Brachyrhamphus*) *marmoratus*, Bonaparte, Tabl. Comp. Pelagiens, Comptes Rendus, 1856, xlii, p. 774.

Cepphus perdix, Pallas, Zoog. R.-A. ii, 1811, p. 351, pl. 80.

Uria Townsendii, Audubon, Orn. Biogr. v, 1839, p. 251, pl. 430; octavo ed. vii, 1844, pl. 475. The figure of the supposed young is the adult; that of supposed adult may be really *B. Wrangelii.*

* "With a black bill; crown dusky; throat, breast, and belly mottled with black and white; back and sides very glossy, and marbled with black and rust-color; wings dusky; greater coverts edged with white; tail black; legs yellow; webs black. Length 9 inches." Pennant, l. c. From Prince William Sound. Of this species, Vieillot, (Nouv. Dict. xiv, 1817, p. 36,) not exhibiting great sagacity, remarks, that it is "une jeune guillemot grylle, qui commence à prendre la livrée de l'adulte!"

? *Uria brevirostris*, Vigors,* Zool. Journ. iv, 1828, p. 357, and Zool. Beechey's Voy. Blossom, 1839, Ornith, p. 32. Evidently a young bird; may be of this species, or of *B. Wrangeli.*

? *Brachyrhamphus Kittlitzii*,† Brandt, Bull. Acad. Sc. St. Petersburg, ii. 1837, p. 346. Young bird; may be of this species, or of *Wrangeli*, or a distinct species.

Coasts and Islands of the North Pacific. On the American side, south in winter to California; breeds as far south as Vancouver's Island. Numerous specimens in Mus. Acad. Philada., Mus. Smiths. Inst., Cab. G. N. Lawrence.

Form typical of the genus as just described. Bill along culmen just the length of the tarsus, tarsus scarcely three-fourths the middle toe without its claw.

Adult, breeding plumage. (Description from No. 49655, Mus. Smiths. Inst., ♂, June 9, 1867, Vancouver's Island.‡ Bill black. Tarsi posteriorly and both surfaces of the webs blackish; legs anteriorly and toes superiorly livid flesh color, or dull bluish gray. Iris brown. Entire upper parts brownish black, everywhere transversely barred with chestnut brown, or bright rust color, except on the wings, which are uniform brownish black, the primaries darkest, their inner webs brownish grey towards the base. Under surface of wings smoky brownish black. A few whitish feathers variegated with chestnut and dusky on the scapulars. Entire under parts, including sides of head, neck and body, marbled with sooty brownish black and white. The feathers are white, with the tips of the dark color. The white rather predominates on the middle of the breast and belly, the dusky on the other parts; the latter color being nearly uniform across the throat, and on the long feathers of the sides and flanks.

Specimens vary a great deal in the precise amount of rusty brown on the upper parts, and of dusky mottling on the lower; but, so far as known, are never without this distinctive coloration in some degree; and it becomes heightened at the breeding season..

Length about 10·00; extent about 18·00; wing 5·00; tail 1·50; tarsus ·70; middle toe 1·00, its claw ·20; outer toe and claw 1·15, inner do. ·90; bill along culmen ·70, along rictus 1·35, along gonys ·55, heighth opposite base of nostrils ·25, width at same point ·20.

This species was originally described by Pennant as the Marbled Guillemot, whence *Colymbus marmoratus*, Gm. His description is that of the adult, in breeding plumage, but has been almost universally supposed to refer only to the young; and a very different species has been usually held to be the adult, as shown in the next article. It is also evidently the *Cepphus perdix* of Pallas.

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* "U. suprà griseo-fusca, capite, dorsoque albo notatis; subtus alba, fusco undulatim maculata, rectricibus albis, dualus mediis fusco-notatis, rostro brevi, gracili.—Alæ suprà et infrà, tectricesque inferiores fuscæ. Rostrum nigrum. Pedes flavi, membranis unguibusque brunneis. Longitudo corporis 9; rostri ad frontem ½, ad rictum 1⅛, alæ 5¼; caudæ 1; tarsi ½." Vigors, l. c. From San Blas.

† "Supra cinerea nigricante et pallide e fusco-flavescente undulata et submaculata. Subtus alba, subfuscescente tenuissime lavata, nigro et quidem in pectore frequentius undulata. Alæ e cinerascente et fusco nigræ. Rostrum brevissimum, capitis longitudinis tertiam partem circiter adæquans. Tarsi digito medio breviores. Longitudo a rostri apice ad caudæ apicem 9. Patria Kamtschatka."—Brandt, l. c.

‡ The following is an extract from a letter to Prof. Baird, from J. Hepburn, Esq., dated Victoria, Sept. 5, 1867, which accompanied a lot of specimens of which No. 49655 was one. It confirms the views maintained in the present paper, and gives some interesting facts: "You will find in the box a specimen of *B. marmoratus*. On comparing it with Mr. Cassin's description. (in Birds N. A.) I find it is what he calls the young bird. In this he is mistaken. In the first place, if such were the case we should see some red birds among the large numbers that are to be found here, whereas till this year I never saw but one specimen, * * In the next place, when I fell in with them last May, every bird was in the red plumage, including the one which, as I told you, would have laid an egg in two or three days; and lastly, proof conclusive, I have shot the young bird, two-thirds grown, in the winter plumage of the adult, except that the breast is more thickly barred than in any specimens I have seen in the winter, and at the very time the adults were in their red plumage."

Audubon's figure and description of the supposed young of this bird, under the name of *Uria Townsendii*, is really that of the adult. His figure of the supposed adult appears rather to represent *Wrangeli*.

It is difficult, perhaps impossible, to determine *Uria brevirostris* Vigors. This is evidently, as far as can be judged by the description, a young bird. It belongs to the short-legged group of the present genus; but whether it is the young of *marmoratus* or of *Wrangeli*, is a point which cannot be decided. The expression "capite dorsoque albo-notatis," and the absence of any mention of rust-color in the description, would lead one to assign it rather to *Wrangeli*.

Brachyrhamphus Kittlitzii, Brandt, is another bird which has not been identified since its original description. Like *U. brevirostris*, it is evidently a young bird, of the short-legged group; and the expression "fusco-flavescente undulata" induces the presumption that it is really only a young *marmoratus*. But it is possible that both it and *B. brevirostris* may be the young of the same species, or of two different species, which yet remain to be identified. It is not probable, however, that either of these names represent valid species, distinct from each one of those recognized in this paper.

Brachyrhamphus Wrangeli, *Brandt*.

Brachyrhamphus Wrangelii, Brandt, Bull. Acad. St. Petersburg, ii, 1837, p. 344. "Rostrum capitis dimidii circiter longitudine. Caput supra, nucha et dorsum e nigricante grisea. Alæ et cauda nigræ. Reliquæ partes, nec non stria longitudinalis supra alam, albæ. Tarsi digito medio breviores. Longitudine a rostro apice ad caudæ apicem 9½. Patria Insulæ Aleuticæ." Cassin, Birds N. A. 1858, p. 917. Copies Brandt's diagnosis.

Brachyrhamphus marmoratus, Cassin, B. N. A. 1858, p. 915, in part. Description of supposed adult *marmoratus* is that of *Wrangeli*.

Aleutian Islands, and north-west coast of America; south to Puget's Sound, and perhaps further. Numerous specimens in Mus. Smiths. Inst. (No. 11,457, perfectly adult, Puget's Sound, in February; No. 46,547, just fully fledged, Sitka; and others from same locality in various stages of adolescence; No. 46,542, Sitka, in January.)

Description (from No. 46,541, Mus. Smiths., perfectly adult male, Sitka, March, 1866).—With the size and proportions of the several members as in *marmoratus;* the bill absolutely shorter, relatively rather stouter. Bill scarcely as long as the tarsus. Tarsus much less than middle toe without claw.

Adult—Entire upper parts, except the scapulars, very dark cinereous, the centres of the feathers, particularly on the back and rump, blackish, causing these parts to appear obsoletely waved with blackish and cinereous; the crown of the head, the wings and the tail, almost black, the larger wing coverts just appreciably white-margined; scapulars almost entirely pure white, forming two conspicuous broad longitudinal bands. Under wing coverts dusky brown; inner webs of the primaries the same, not fading, even at their extreme bases, into whitish. Entire under parts pure white, immaculate, except some dusky streaks on the long feathers of the sides and flanks. This white on the sides of the head invades the lores to the level of the top of the orbits, and extends into the nasal fossæ; then lowers a little, so that the eyes are left in the dark color of the top of the head; then on the nape extends almost to the median line, across which a few white feathers extend to the white on the other side, forming an imperfect nuchal collar; then extends in a straight line down the middle of the side of the neck. On the sides of the rump the white extends around so far, that the cinereous is only left as a band an inch wide. This white on the sides of the rump is as apparent upon the upper surface as that on the scapulars; it is directly continuous with that of the under parts, but on the flanks the long overlying cinereous feathers appear to separate it. Bill wholly black. Tarsi posteriorly and toes inferiorly blackish; rest of the feet, including both surfaces of the webs, probably flesh-colored in life; dull yellowish-white in the dried skin.

Length "10·00, extent 18·00" (collector's label); wing from carpus 5·00; tail 1·50; tarsus ·70; middle toe without claw ·92, its claw ·20; outer toe and claw 1·10; inner do. ·88; bill along culmen ·60, along rictus 1·25, along gonys ·45, its height at base of nostrils ·22, its width at same point ·19.

Young. (No. 46.547, Mus. Smiths., Sitka, July, 1866; just fully fledged; the bill has still the white horny knob at tip of upper and under mandible, showing the juvenility of the specimen).—Bill very small, weak, short, imperfectly developed, about a third as long as the skull; ·45 along culmen; tarsus ·55; middle toe and claw 1·00; wing only 4·25. Entire upper parts blackish, much darker than in the adult, with only a just appreciable shade of cinereous; the scapular white present, but restricted in extent, and interrupted by imperfect bars of dusky across the feathers. Entire under parts white. Everywhere, except on chin, middle of abdomen, and under tail coverts, thickly marked with delicate waved lines of dusky, most numerous across the throat, largest on the sides and flanks, where some of the longer feathers are mostly dusky, finest on the lower breast. The whitish on the sides of the head does not extend so far, and merges insensibly into the dark color; on the nape a delicate line of white feathers almost forms a collar. The under wing coverts are as in the adult. Bill blackish. Legs and feet anteriorly more dusky than in the adult.

Another specimen (No. 46,542, Mus. Smiths.), taken in January, marked female, and evidently hatched the preceding summer, has the size of the adult, and the colors generally as in the young bird just described. But the upper parts are much lighter and more decidedly cinereous, as in the adult; the scapular white well developed; the dusky waving of the under parts confined to the sides and throat. The under wing coverts are dusky along the edge of the wing; but are elsewhere variegated with dull whitish; only to a small degree, however, not approaching the condition seen in *hypoleucus*.

In mature plumage this is a very handsome bird, and recognizable at a glance by the pure white of the under parts, and blackish cinereous of the upper, relieved by the conspicuous white of the scapulars and sides of the rump. It belongs to the short-legged division of the genus, being very different from *hypoleucus* and *Craveri* in the proportions of the tarsus and toes. It has the size and form of *marmoratus* in every respect except a just fairly recognizable difference in the shape of the bill. But it is quite a different species from *marmoratus;* so different, in fact, that no special comparison need be instituted.

The recognition, in the bird here described, of *Brachyrhamphus Wrangeli*, Brandt, is a matter of unusual interest, identifying, as it does, a species long ago described, but almost unknown to ornithologists at large, and throwing light upon what has always been a very obscure point in American ornithology. The writer is mainly indebted to Prof. Baird's suggestions for the fortunate direction of his investigation in this case. The present species has hitherto been regarded and described by American writers as the *adult* of the well-known *marmoratus*, whose curious colors, as described by all authors from Pennant downwards, and as figured by Audubon under the name of *Uria Townsendii*, have always been considered as indicative of immaturity. But numerous specimens, in adult *breeding* plumage, demonstrate the falsity of this view, as is satisfactorily set forth in the preceding article. Beyond the possibility of a doubt, the present species is not *marmoratus;* and it is certainly *Wrangeli* of Brandt.

BRACHYRHAMPHUS HYPOLEUCUS, *Xantus.*

Brachyrhamphus hypoleucus, Xantus, Proc. Acad. Phila. Nov., 1859. From Cape St. Lucas. Baird, eodem loco.

Coast of California. Specs. in Mus. Smiths., and Mus. Acad. Philada. So far south, in summer, as Cape St. Lucas, Lower Cal.

Description (from No. ———, Mus. Smiths., ♀, San Diego, Jan. 27, 1862; a typical example).—Bill along culmen half as long as the skull, three-fourths as long as the tarsus, as long as the middle toe and half its claw, very slender, much compressed, higher than wide at the base; culmen gently curved its whole length; rictus nearly straight; gonys perfectly straight; outline of the very slender mandibular rami a little concave. Tarsus just as long as the middle toe without its claw! Tip of inner lateral claw not reaching base of middle one. Wings and tail of usual shape; the latter contained about two and a third times in the length of the former from the carpus. Under tail coverts reaching (in this specimen) just beyond the end of the tail. Entire upper parts uniform cinereous, not varied by white. This color is slightly darker, and more blackish-plumbeous on the head. It extends on the sides of the head just to the eyes, the lids of which are of this color, a little further down on the auriculars; thence in a straight line along the middle of the side of the neck to the shoulders; thence in a straight line along the sides under the wings, where it is nearly an inch broad; the elongated feathers of the flanks are also mostly of this color. Other under parts entirely pure white. Under surface of wings entirely pure white! Primaries black on the outer web; the greater part of the shaft and inner webs white; the terminal portion of the shaft and inner webs brown. Tail feathers black, the inner webs somewhat brownish. Bill black, the base of the lower mandible whitish; feet anteriorly dull yellowish, posteriorly dusky, in the present dried state; "bill black, feet whitish-blue, black below" (label).

"Length 10·50; extent 17·50" (label); wing 4·80; tail 1·70; tarsus ·95; middle toe without claw ·95, its claw ·20; outer toe and claw 1·10; inner do. ·90; bill along culmen ·80, along rictus 1·30, along gonys ·45; depth at base ·22; width ·19.*

The specimen above described, collected at San Diego, Cal., by Dr. J. G. Cooper, is a little larger than the type, as will be seen by comparing the measurements with those in the accompanying foot-note. It is also described as representing the perfect plumage,—the type being imperfect in this respect. The upper parts are of a uniform very dark cinereous, without a shade of brown; the latter hue only occurring in specimens with worn and faded plumage. In the original description, here appended, the indications of the size of relative lengths of the tarsus and middle toe are made without reference to the claw; which fact explains an apparent discrepancy between the present description and the original one. The tarsus is exactly as long as the middle toe without its claw.

This is a very strongly marked species. The most striking diagnostic feature is the pure white of the under surface of the wings. In the uniformity of the cinereous color of the upper parts it is also unique. Nearly the same length of tarsus is found in *B. brachypterus*, Brandt, and *Craveri*, Salvadori; the tarsus is much shorter than the middle toe in *Wrangeli* Brandt, *marmoratus* Gm., "*Kittlitzii*" Brandt, and "*brevirostris*" Vigors.

This species is certainly not the *Uria brevirostris* Vigors, from San Blas. This is described as having "alæ suprà et *infrà*, tectricesque inferiores fuscæ, * * tarsi ½," which settles all questions on this score. It has the same dimensions, and the same relative length of tarsus and toes as *Craveri* Salva-

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* The following is the original description of the type specimen: "Bill slender and slightly curved, about half the length of head. Tarsus scarcely shorter than the middle toe [and claw]. Above dark brownish-black, the edges of the feathers with a decided plumbeous tinge; the side of neck below, and the axillars with the concealed portion of the sides of the breast, ashy plumbeous. Entire under parts, including tail coverts and inside of the wings, pure white, this color extending on the sides of the head so as to include the eyes; the lids, however, are tinged with dusky; bill black; legs apparently reddish in life.

"Length 10 inches, extent 15·80, wing 4·70, tail 1·80, bill above ·70, gape 1·20, tarsus ·85, middle toe [with claw] 1·00. This specimen is considerably weather-beaten, and the old feathers of the upper parts are much worn, and bleached at the edges. The new ones are, however, as described."

dori, also from the coast of Lower California; but the latter appears to be a different species, as will be discussed further on. It comes nearest to *brachypterus*, from Unalaschka; in fact there is nothing in Brandt's brief diagnosis preventing the reference of the present species to *brachypterus*, except the expression "tarsi digito medio longiores." But in view of this discrepancy, and of the widely-separated localities whence the two species are described, it would be unsafe to take their identity for granted. It is much the best course to retain the present species as it stands, under the name *hypoleucus*, which has the merit of being positively identified, as is not the case, as yet, with *brachypterus*.

Several excellent examples of this species from various points along the coast of California are in the collections of the Smithsonian Institution and Philadelphia Academy. They present no individual differences worthy of special mention; except in the instance of the type specimen, which is brownish above, from the faded and worn condition of the plumage.

This species has probably the southernmost range of any of the family; occurring in summer at Cape St. Lucas. It was observed by the writer in December, 1865, off the coast of Mexico, about latitude 21° N.! Its extension northward remains to be ascertained. At present, it is not known to occur north of the coast of Lower California. Its southern habitat, as remarked by Prof. Baird, is a fact of great interest, when it is recollected how truly boreal are nearly all the species of the family.

BRACHYRHAMPHUS CRAVERI, (*Salvad.*) *Coues.*

Uria Craveri, Salvadori, Descrizione di altre Nuove specie di Uccelli esistenti nel museo di Torino, 1867, p. 17. Estratto dagli Atti della Società Italiana di Scienze Naturali, vol. viii, 1866.

"*Jun.*—Uria minima, crassitie *Merguli alle;* suprà fusco-nigra, dorso ac alis nonnihil griseo-tinctis. Subtus alba; rostro valde elongato, subulato, nigro; tarsis postice nigris, antice viride-luteis; unguibus nigris.

"Long. tot. 0,245; al. 0,125; caud. 0,018; rostri a rictu 0,037; tarsi 0,022; dig. med. cum ungue 0,024; (millimetres.)

"Parti superiori, lati della testa, le piume del mento lungo il margine inferioré della mandibula, lati del collo, del petto, e fianchi di color bruno-nero con una leggera tinta grigio-lavagna sul dorso, sul groppone e sulle ali; parti inferiori candide; becco nero; tarsi neri posteriormente, anteriormente giallo verdastri como auche le dita; unghie neré.

"Questa specie sarebbe commune lungo le coste del Golfo della California, e nell' Isola della Natividad posta nel Pacifico, a poca distanza dalla costa occidentale della Bassa California."—Salvadori, l. c.

This recently described species has much the same habitat as *B. hypoleucus*, and very much resembles the latter. The dimensions are the same in both, and the colors are very nearly alike. The expression "fusco-nigra, * * griseo-tinctis," exactly hits some specimens of *hypoleucus*,—those somewhat faded and worn in plumage,—though not applicable to more perfect specimens. In the above copied description, no mention is made of the under surfaces of the wings; but the needed information in this regard has been supplied through a private channel. Prof. Baird has received from Sig. Salvadori, and kindly transmitted to the writer, a life-size figure of the bird, accompanied by a note in which it is stated that "the lining of the wings is blackish, and some feathers are white-edged." This fact at once distinguishes the species from *hypoleucus*, providing the latter, in all stages of plumage, has the under surfaces of the wings white, as is most probable, judging by what is known of the variations in plumage of the birds of this genus.

Waiving the bare possibility of this bird s being a *young hypoleucus*, it cannot be referred to any described species, and must be regarded as a valid one. That it is not *brevirostris*, Vigors, is sufficiently evident from the dimensions; the tarsus of the latter being only half an inch long.

BRACHYRHAMPHUS BRACHYPTERUS, *Brandt.*

Brachyrhamphus brachypterus, Brandt, Bull. Acad. Imper. St. Petersb. ii. 1837, p. 346. Quotes "*Uria brachyptera* Kittlitzii, MSS." Gray, Genera, iii, 1849, p. 644. Cassin, Birds N. A. 1858, p. 917. Merely copies Brandt's description.
Anobapton (*Brachyrhamphus*) *brachypterus*, Bonaparte, Tab. Comp. Pelagiens, Comptes Rendus, xlii, 1856, p. 774.

"Suprà cinerea, alis caudaque nigricantibus. Collum subtus et in lateribus, pectus et abdomen alba. Rostrum capitis dimidii circiter longitudine. *Tarsi digito medio longiores.* Longitudine a rostri apice ad caudæ apicem 9. Patria Unalaschka."—*Brandt, l. c.*

This species is wholly unknown, at least on this side of the Atlantic, except by the above cited description of Brandt. It has nothing to distinguish it from some other *Brachyrhamphi* except the length of the tarsus. This, however, if it really obtains, is sufficient to distinguish the bird from all others, not only of the genus, but of the family; for no known alcidine bird has the tarsi longer than the middle toe.

URIA, (*Moehr.*) *Brisson.*

Columba sive *Columbus*, Auct. antiq. ex parte. *Uria*, Moehring, Av. Gen. 1752, p. 67, No. 73. Type *Columba groenlandica*, Willoughby.
Uria, Brisson; Brünnich, Orn. Bor. 1764; and of authors generally.
Alca, Linnæus, Syst. Nat. i, 1758: in part.
Colymbus, Linnæus, S. N. i, 1766, in part, and of many of the older authors.
Cepphus, Pallas, Spic. Zool. v. 1769, in part.
Grylle, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 346. Type *U. grylle*, Brünn.

Bill much shorter than the head, about equal to the tarsus, straight, rather stout, moderately compressed; culmen at first straight, then rapidly deflected; rictus straight, except just at tip; gonys ascending, straight, short, about half as long as the culmen. No groove in sides of upper mandible near its tip; commissural edge of upper mandible scarcely inflected. Nasal fossa wide, long, deeply excavated, partially bare of feathers, which do not wholly obtect the nostrils. Feathers extending on sides of lower mandible with a salient rounded outline. Wings and tail very short, the latter contained about two or two-thirds times in the length of the former from the carpal joint to the end of longest primary; tail slightly rounded. Tarsus much compressed, entirely covered with polygonal reticulations, somewhat scutelliform on the inner aspect; slightly shorter than the middle toe without its claw. Outer and middle toes equal in length; the claw of the former much smaller than that of the latter, tip of inner claw just reaching base of middle one. Claws compressed, moderately arched and acute; the outer one grooved along its outer aspect. the middle one greatly dilated along its inner edge. No postocular furrow in the plumage.

In the preceding diagnosis the characters of the genus are so drawn as to exclude the large species of *Lomvia*. Few writers have made this generic distinction, for which, notwithstanding, there is abundant reason, as may be seen upon a critical comparison of the two types of form; and as will be satisfactorily demonstrated at length under head of *Lomvia*. It need only be noted here, that the structure of the bill and feet are in many respects very different in the two genera.

The genus as here framed comprehends three distinct species, intimately allied to each other.

Species:—(3.)

Disregarding other and less prominent though very valid distinctions, the three species of Uria may be at once recognized by the following characteristics:—

A large white space on wing, entire. No white about head .... 1. *grylle.*
A large white space on wing partially divided by a black line. No white about head.. 2. *columba.*
No white on wing. Feathers around and behind eye and at base of bill, white.. 3. *carbo.*

Or they may be still more briefly and quite as satisfactorily characterized thus:—*carbo*—upper and under surfaces of wings black; *grylle*—upper and under surfaces of wings white; *columba*—upper surfaces of wings white, under black.

The division of the white mirror on the upper surface of the wings of *columba* is not the most important point of coloration, though the most obvious, upon casual inspection, by which the species differs from *grylle*. A still stronger diagnostic character lies in the absence of white on the under surface of the wings.

URIA GRYLLE, (*Linn.*) *Brünn.*

Columba groenlandica, "Linnæus, Syst. Nat. vi, ed. 1746, p. 23, No. 4. Albanus, Av. ii, p. 73, pl. 88. Ray, Syn. Av. p. 121, No. 6. Willoughby, Orn. p. 245, pl. 78. Martens, Spitzburg. p. 56, pl. 50, fig. B."
Columbus groenlandicus, "Klein Av. p. 168, No. 2."
Uria groenlandica, Brünnich, Orn. Bor. 1764, p. 28, No. 116, (blank.)
Uria nigra, striata, et minor, Brisson.
Alca grylle, Linnæus, Syst. Nat. i, 1758, p. 130. Schlegel, Urinatores Mus. Pays-Bas. livr. ix, 1867, p. 130, excl. synon. *Cephus columba*, Pall.
Colymbus grylle, Linnæus, Syst. Nat. i, 1766, p. 220. Hermann, Tabl. Affin. Anim. p. 148. Blumenbach, Handb. Naturg. p. 220 Müller, Zool. Dan. Prodr. p. 18. Gmelin, Syst. Nat. i, 1788, p. 584. Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 871. Several states of plumages enumerated as varieties.
Uria grylle, Brünnich, Orn. Bor. 1764, p. 28, No. 113. Latham, Ind. Orn. ii, 1790, p. 797, No. 2. Var. "B," is *columba*; perhaps also var. "E," the same. Temminck, Man. Orn. ii, 1820, p. 925. Vieillot, Gal. Ois. ii, 1825, p. 235, pl. 294. Bonaparte, Syn. B. N. A. 1828, p. 423. Audubon, Orn. Biog. iii, 1835, p. 148, pl. 219 and B. Amer. vii, 1844, p. 474. Peabody, Rep. Nat. Hist. Mus. 1840, Birds, p. 399. Gray, Genera Birds iii, 1849, p. 644. Thompson, Nat. Hist. Ireland, iii, 1851, p. 214. Macgillivray, Hist. Brit. Birds, 1852, ii, p. 331. Cassin, Birds N. A. 1858, p. 911, pl. 96, fig. 2; and Pr. A. N. S. Philada. 1862, p. 323. Herald Island. Bryant, Proc. Bost. Soc. Nat. Hist. May, 1861, p. 74. Coues, Pr. A. N. S. Philada. 1861, p. 225. Verrill, Proc. Bost. Soc. Nat. Hist. 1862, p. 131, and p. 142, and Proc. Essex Inst. iii, 1863, p. 160. Samuels, Ornith. and Ool. New Engl. 1867, p. 567.
Uria (*Grylle*) *grylle*, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 346.
Uria (*Cephus*) *grylle*, Bonaparte, Comptes Rendus, 1856, xlii, p. 774.
Cephus grylle, Fleming, Hist. Brit. Anim. 1842, p. 134.
Cepphus lacteolus, Pallas, S. Z. v, 1769, p. 33. Albino, perhaps *columba*.
Colymbus lacteolus, Gmelin, Syst. Nat. i, 1788, p. 583. Albino. "C. niveus, rostro pedibusque ex carneo fuscescentibus." Donndorff, Beytr. Zool. ii, pt. i, 1790, p. 870.
Uria lacteola, Latham, Ind. Orn. ii, 1790, p. 798. Albino.
Uria grylloides, Brünnich, Orn. Bor. 1764, p. 28, No. 114. Changing plumage.
Uria balthica, Brünnich, Orn. Bor. 1764, p. 28, No. 115. Immature or winter.
Uria nivea, Bonnaterre, Ency. Method. Orn. 1790, p. 37. Albino, possibly of columba. Quotes Pall. Spec. Zool. v, p. 33.
Uria leucoptera,* Vieillot, Nouv. Dict. d'Hist. Nat. xiv. 1817, p. 35.

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* "Cet oiseau, dont je ne connais pas le pays natale, est totalement d'un noir profonde, avec une grande plaque blanche sur l'aile; sa taille est à peu près la même que celle du précédent," (*U. troile*)—*Vieill., l. c.*

Uria unicolor, Faber, Prodr. Isl. Orn. 1822, p. teste Schlegel. Greenland. without white on wings.
Uria (*Lomvia*) *unicolor*, Bonaparte, Comptes Rendus, 1856, xlii, p. 774.
Uria Mandtii, Lichenstein, Verz. 1823, p. 88, teste Schlegel. Spitzenbergen. Not of authors, which usually refers to *columba*.
Uria scapularis, Stephens, Shaw's Gen. Zool. xii, 1824, p. 250, pl. 64.
Cephus glacialis, *arcticus*, *Faroensis*, et *Meisneri*, Brehm.

European and American coasts and islands of the North Atlantic; very abundant. Arctic Ocean. Spitzbergen, Iceland, Greenland. On the American coast, in winter, south to New Jersey coast. Rare or accidental in the north Pacific, where replaced by *columba* and *carbo*.—? Kamtschatka, (Mus. Pays-Bas, fide Schlegel.)* Herald Island, Arctic Ocean, (Cassin, Pr. A. N. S. Ph. 1862, p. 323); Spec. in Mus. Acad. Phila., Smiths. Inst., Bost. Soc. Nat. Hist.; Essex Inst.; Cab. G. N. Lawrence; author's Cab.

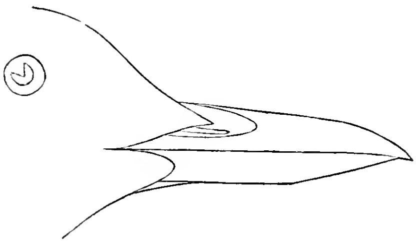

Fig. 13.—*Uria grylle*.—Nat size.

Adult, summer plumage.—Bill and claws black Mouth, legs and feet brilliant vermilion red, tinged with carmine. Entire plumage plumbeous or fuliginous black, with a tint of invisible green. Wings and tail pure black, the former with a large oval space on the upper coverts, all the under coverts and the subscapulars pure white.

This perfect breeding plumage is temporary, and lasts but a short time. Very many individuals do not assume it until June; and it is usually retained only during this and the succeeding month. Most specimens collected in May are found to still have some traces of the winter plumage, below described.

Adult, during autumnal change. The first indication of the moult is seen in the wings and tail, and is to be observed in nearly all specimens taken after July. By the latter part of this month, after incubation and nursing are finished, the wing and tail feathers become much worn, and faded, turning to a light brownish gray towards their tips. The white mirror shows scattered traces of dull brown. The body color loses its hue of green, and becomes more fuliginous brown. Isolated white feathers are scattered over the whole body; or the dark feathers acquire white tips. With the falling of the quill feathers, which may take place very rapidly, and deny for a season all power of flight, the bird is in the following condition, which is the pure *moulting* state, exactly intermediate between the summer and winter plumages:—No. 18254, Mus. Smiths., Labrador, Aug. 14, 1860. E. Coues. Wing feathers renewed, pure black, but not fully grown; wing from the carpus only 4·50 long. Mirror of renewed feathers, almost or quite pure white, but small; under wing coverts and axillars pure white. Head and neck all around, rump, and whole under parts marbled with black and white in equal quantity, the bird looking as if dusted over with flour. Back black, most of the feathers lightly bordered with white, the scapulars more largely white. A still further increase of white produces the following:—

Adult, winter plumage.—Wings and tail black, the mirror and under wing coverts faultlessly white. Head and neck all around, rump and entire under

* Although this author does not recognize the specific validity of *U. columba*, and would therefore range specimens of the latter under *grylle* in his catalogue, a specimen (No. 5.) there enumerated appears to be this species, as is inferrible from the expression "Au miroir d'un blanc pur."

parts pure white; the back, (and frequently the crown, and back of neck,) black, more or less variegated with white. Audubon figures this condition very nearly.

The change in spring—mostly occurring during April and May—is the reverse of that already described as the autumnal moult.

Fledgelings.—(Labrador, July, 1860, E. Coues, Mus. Smiths. No. —.) Length about 6·00; bill ·50; tarsus ·60; middle toe and claw ·90, etc. Wholly covered with soft wooly puffy down, fuliginous brownish black; bill and feet brownish black.

Young, first plumage.—Traces of the down on various parts of the body; the bird probably just beginning to fly; length about 10·00, wing 11·50; bill 1·00, black; tarsus 1·25; reddish dusky, as also are the toes. Upper parts plumbeous or sooty black, scarcely varied with white. Mirror beginning to appear, as white spotting on a blackish ground. Entire under parts white, thickly marbled, rayed and undulated with light touches of dusky.

This state tends to pass directly into a condition exceedingly similar to, if not identical with, that of the adults in winter. But birds of the first winter may, at least early in the season, be distinguished from old ones by a certain "feel" of the plumage, and a shorter, weaker bill, less developed as to its ridges and angles.

Accidental variations.—The foregoing descriptions apply to the various stages of plumage, which are strictly normal in character, and which, though unending in precise degree, and varying with almost every individual, merge insensibly into each other. The species is, however, also very subject to accidental and entirely abnormal variations. Of these, albinism is the most common. (Spec. in Mus. Acad. Philada.) Entirely milk white, without a trace of black; bill and feet light colored; eyes probably pink in life. The opposite condition of melanism is described by authors. This consists in the total absence of white on the wings; and is apparently of infrequent occurrence. Both these conditions have been described and named as characterizing distinct species. In the latter, the bird must not be confounded with *Uria carbo*, which is totally different.

Dimensions.—Adult: Length, (average) 13.00; extent, (average) 22·50: wing 5·50 to 6·25; tail 2·00, a little more or less; bill along culmen 1·30; along rictus 1·75; along gonys ·65; depth at base ·45, width ·35; tarsus 1·25; middle toe and claw 1·75, outer do. slightly less, inner do 1·40.

It may be of advantage to look closely into the formation of the white area upon the wing of this species, to the end that its composition may be clearly understood, and recognized as different from that which obtains in the allied species, *U. columba.* The mirror upon the upper coverts varies to a degree, and in a precisely similar way, in each species; but when perfect constantly presents a radical difference.

When *Uria grylle* is observed flying, as is its wont, low over the water with rapid beats of the wings, the eye receives the impression of a black bird, with a large white circular spot on the wing. This spot is constantly in view, and represents the retinal image resulting from the white spaces upon both the upper and under surface of the wings blended together by the rapid motion of the wings. Those who have observed *Uria grylle* in its native haunts will appreciate the pertinence of this remark. *Uria columba* presents no such peculiarity of appearance, there being no white upon the under surface of the wings; and the eye readily follows the movement of the small white space upon the wings, as with the changing attitudes of the bird, it is now apparent, now lost to view.

In *Uria grylle*, the row of great coverts upon the secondary quills are basally black, terminally white. The outermost are white for rather less than half their length, and the white occupies chiefly the exterior webs. Nearer the body they are white for more than half their length, and the white occupies both webs of the feathers.

The next row of coverts are wholly white in their entire length, except perhaps for a very brief space just at their base; and they are throughout long enough to cover entirely the dark portion of the first row, reaching a little beyond and overlying the commencement of the white upon the latter; so that the white is continuous and unbroken. One or two more rows of coverts have precisely the same character and continue the white space uninterrupted.

The shorter coverts, for about half inch from the edge of the antibrachium are black. The last of these, however, are broadly tipped with white, which white portion overlies the extreme bases of the next row, blending its color with that of the latter; the anterior edge of the mirror being thus the line of union of the black and white portions of these coverts, taken collectively.

In *Uria columba*, the row of great coverts is externally wholly black, or at most the outermost feathers have only a very narrow white tip. The amount of white on the feathers increases rapidly from without inwards, until on the innermost there is nearly or quite as much white as in *grylle*. In consequence of the small amount of white on these coverts, the next row of coverts do not overlie, nor even reach it; there being left a broad space of dusky between the white tips of the second row of coverts, and those of the first; which space rapidly diminishes from the edge of the wing towards the body, forming the curved crescent of dusky which is obvious upon the wing of this species.

The mirror of *Uria grylle* is subject to much variation, which, however, never obscures its distinctive characters in any decided degree. The greater coverts may be wholly dusky; then the mirror is the same as before, except in its smaller size; the next row may be tipped with dusky, so that no white comes forward to coalesce with that of the greater row, and an appearance like that of *columba* is produced; which need not deceive, since the dusky results from the second row of coverts instead of the first. All the wing coverts may be tipped with dusky; producing a variegated or spotted mirror. Finally, the mirror may be only indicated by a few isolated white feathers, or may be altogether wanting.

It is to be borne in mind, that the difference in the mirror of *U. grylle* and *columba* is only one of the most obvious, but not the most specific distinction. In the very possibly occurring cases in which there is absolutely no difference between specimens in this respect, the absence of the white under the wing, and the shape of the bill, readily distinguish *columba* from *grylle*.

Perhaps no bird has so many synonyms as *Uria grylle*. Independently of its reference to divers genera, a large number of nominal species have been instituted upon its various stages of plumage, some of them requiring brief notice. A very common name for the species among pre-Linnæan writers was "Columba groenlandica,"—obviously a mere rendering into Latin of a popular designation. The word "grylle" made an early entry into the records, designating the adult plumage. *Grylloides* of Brünnich represents a variegated condition; and *balthica* of the same author an immature or winter state. *Lacteolus* of the older authors seems to have been based upon the albino condition; the bird being described as "*niveus, rostro pedibusque* ex carneo fuscescentibus." It is possible that Pallas, who introduced the word, may have really based it upon a specimen of *columba*; but this is a point of no special consequence. Bonnaterre has another name,—"*nivea*"—for the same condition, quoting Pallas, Sp. Z. v, p. 33. Brisson and Brehm both have a large number of nominal species, not necessary here to particularize. In 1817, Vieillot (l. suprà cit.) describes an adult under the name of *Uria leucoptera*, erroneously assigning it dimensions nearly equal to those of *Lomvia troile*. At least the presumption is that this *leucoptera* is nothing but a large *grylle*, though he must have been perfectly familiar with the latter. Even so late as 1824, *grylle* is redescribed as *Uria scapularis*.

The "*Uria Mandtii*" of Lichtenstein requires attention, having been extensively quoted as a synonym of, or employed to designate, *U. columba*, as will be seen by the list of synonyms under head of this species. It is not possible to determine from the description whether *Mandtii* is really based upon *columba* or upon *grylle*. But Dr. Schlegel describes a specimen from Spitzbergen in the Mus. Pays-Bas.—"un des individus types de l'*Uria Mandtii* de Lichtenstein, obtenu du Musée de Berlin," as having the white feathers of the mirror tipped with clear brown, and the wing and the tail feathers faded grayish. This is a common condition of autumnal specimens of *grylle*; and the description does not point more particularly to *columba* than to this species. Upon the whole, it may be best to regard *Mandtii* Licht. as a synonym of *grylle*: though the name as used by Brandt, Bonaparte and some others refers unmistakeably to *columba*.

A certain *Uria unicolor* is described by Faber and Benecken and admitted as distinct in the Comptes Rendus for 1856, by Bonaparte, who moreover places it in a different subgenus from *grylle*. Bonaparte does not use the term to designate *carbo* Pall., which latter he gives as distinct. The name seems to have been based upon the melanotic state of plumage of *grylle*. Dr. Schlegel describes, in the ninth livraison of the Mus. Pays-Bas Catalogues, one of Faber's type specimens from Greenland, as being "Au plumage d'un noir enfumé absolument uniforme."

Uria columba, (*Pallas*) *Cassin*.

Black Guillemot, variety from Kamtschatka, "with a white oblique line issuing from the white spot on the wings," Pennant, Arct. Zool. ii, 1785, p. 517.

Uria grylle, var. B, Latham, Ind. Orn. ii, 1790, p. 797. "Fuliginosa, fascia alarum gemina alba. Lath. Syn. vi, p. 333, No. 3, var. a. Habitat in Aoonalashka."

Colymbus grylle, var. B, Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 872. Quotes Latham and Pennant.

Cepphus columba, Pallas, Zoog. R.-A. 1811, ii, p. 348. "In speciminibus orientali oceani, fascia alarum duplex," etc. (p. 349.)

Uria columba, Cassin, Voy. Vincennes and Peacock, Orn. Atlas, pl. 38, fig. 1. Idem, Baird's B. N. A. 1858, p. 912, pl. 96, fig. 1. Idem, Pr. A. N. S. Phila. 1862, p. 323. Heermann, Pac. R. R. Rep. x, 1859, Route to California, Birds, p. 76. Cooper and Suckley, Pac. R. R. Rep. xii, pt. ii, 1860, p. 285.

?? *Uria mandtii*, Lichtenstein, Verzeich, 1823, p. 88.

Uria mandtii, Reichenbach, Vollst. Naturg. Schwimmvög, pl. 4, fig. 47. Gray, Genera Birds, iii, 1849, p. 644.

Uria (*Grylle*) *mandtii*, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 346.

Uria (*Cephus*) *mandtii*, Bonaparte, Tabl. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774.

Asiatic and American coasts of the North Pacific, Kamtschatka (Mus. Acad. Philada.), Russian America, Washington Territory, California (Mus. Smiths. Inst.) Breeds on the islands off the coast of California.

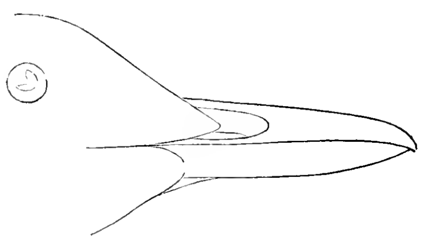

Fig. 14.—*Uria columba*.—Nat. size.

Bill stouter than that of *grylle*, more obtuse at the tip; upper mandible with the culmen straight, or even just appreciably convex, suddenly deflected; rictus straight, ascending to near the tip; gonys and outline of inferior mandibular rami straight.

Adult.—Entirely fuliginous or plumbeous black, with a shade of invisible green. White mirror on wing coverts. Nearly divided in two by a broad rather curved oblique line of blackish. No white on under wing coverts, these being grayish-brown. Bill and claws black. Mouth and feet vermillion red, tinged with carmine. "Iris white" (label).

Length 13·00; extent 23·00; wing 7·00; tail 2·20; tarsus 1·25; middle toe and claw 1·90, outer do. the same, inner do. 1·45; bill along culmen 1·20, along rictus 1·80, along gonys ·65; depth at base ·40; width ·30.

This species closely resembles *U. grylle;* but differs in being upon an average larger, the wing particularly longer; the bill stouter, straighter, more obtuse at the point; and the marking of the wings different, as above described. The changes of plumage and the individual variations, as exhibited in the large series of specimens examined, and entirely parallel with those of *Uria grylle*.

It is worthy of note that this species occurs, in summer, upon the Pacific coast of America, much south of the corresponding latitudes on the Atlantic coasts frequented at this season by *U. grylle*.

One of the earliest indications, if not the first, of this species, may be recognized in the variety of the Black Guillemot from Kamtschatka, described by Pennant. This is said to have a white oblique line issuing from the white spot on the wing. The var. B of *grylle* of Latham and Donndorff is the same bird. Pallas appears to be the first to bestow a specific name. The question involved in the *Uria Mandtii*, Licht., has already been considered in the preceding article.

URIA CARBO, (*Pall.*) *Brandt.*

Cepphus carbo, Pallas, Zoog. R.-A. ii, 1811, p. 350, pl. 79. "C. tridactylus, totus niger, orbites albis," etc.
Uria (*Grylle*) *carbo*, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 346. "Tota nigra, pedibus rubris, orbita et stria ab orbites pone oculos ducta albis."
Uria (*Cephus*) *carbo*, Bonaparte, Comptes Rendus, 1856, xlii, p. 774.
Uria carbo, Gray, Genera Birds, 1849, p. 644. Cassin, Baird's B. N. A. 1858, p. 913, pl. 97. Quotes Reich. Vollst. Naturg. Aves., pl. 375, fig. 2937. Cassin, Pr. A. N. S. Philada. 1862, p. 323 (Japan).
Alca carbo, Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 17.

"In oceano orientale circa insulas Aleuticas, præsertim Unalaschka" (Pallas), Kamtschatka (Mus. Acad. Philada.), Japan (Mus. Smiths. Inst.)

Sp. Ch.—Larger than *grylle* and *columba;* the bill especially larger, stouter and straighter. Feathers of nasal fossæ and those around base of lower mandible whitish. A conspicuous white area around eyes, and extending an inch or so behind them. No white on either surface of wings. Rest of plumage brownish-black, becoming ashy black on the under parts; perhaps deep plumbeous black, with a shade of greenish, in more mature specimens than those examined. Bill black. Legs and feet chrome yellow, tinged with vermillion, webs coral red in the dried state; probably vermillion or carmine red in life.

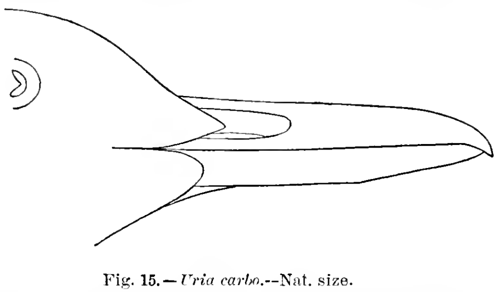

Fig. 15.—*Uria carbo.*—Nat. size.

Length 14 to 15 inches; wing 7·75; tail 2·50; culmen 1·55; commissure 2·20; from feathers on side of lower mandible to tip 1·50, tarsus 1·36; middle toe and claw 2·10, outer 2·00, inner 1·60.

Another specimen: culmen 1·70; commissure 2·10; feathers on side of lower mandible to its tip 1·55; depth of bill at base ·50; width at same point ·38.

An interesting species of *Uria*, easily recognized by its peculiar colors, which are different from those of either of the other two species here described. Although unmistakeably characterized by Pallas, in 1811, as above cited, it seems to have been overlooked by many subsequent writers. It appears, however, in the monograph by Prof. Brandt, who was well acquainted with Pallas' labors and discoveries; and is on different occasions noticed by Mr. Cassin, who has given a figure of it in the Atlas accompanying Prof. Baird's Birds of North America. There is a fine specimen in the Philadelphia Academy, from Kamtschatka; and a mutilated one in the Smithsonian Institution, from Japan. The latter is interesting on account of the new and unusual locality. The bird is chiefly an inhabitant of the higher latitudes on the coasts of the Pacific Ocean. It has not yet become a common bird in collections.

The species is somewhat larger than *grylle* or *columba*, but chiefly noticeable, as far as form is concerned, by the greater stoutness and straightness of the bill, very observable upon direct comparison. The culmen and commissure are nearly straight almost to the very tip, where they are rather suddenly decurved. The gonys and mandibular rami are quite straight; the eminence at their symphysis is well-marked. The nasal fossa is short, but wide and deep; the feathers reach to the nostrils, but do not cover them. These nasal feathers, as well as those around the base of the lower mandible, are dull white. The eyes are conspicuously encircled with white, which stretches behind them for about an inch, tapering to a fine point. There are no indications of white on the wings. With the exceptions just mentioned the whole plumage is sooty-black, tinged with slaty above, with brownish below, and becoming light ashy on the under surfaces of the wings. The bill is black, as in the other species; the inside of the mouth probably carmine red in life. The feet are light yellow in the dried specimens, doubtless vermillion or carmine red in life. The webs are still tinged with this color. The claws are black.

It is possible that the plumage just described is not that of the perfectly adult bird, in which, when fully mature, the white about the sides of the head and base of the bill may not be exactly as here described; and the body colors may be purer and more intense. Dr. Schlegel describes a specimen from the Kurile islands as "d'un noir enfumé uniforme;" and another, from Sachalin island, as an "individu au plumage imparfait; d'un brun fuligineux, passant au blanchâtre sur la face et les côtés de la tête."

LOMVIA, (*Ray*) *Brandt*.

Lomvia, Ray, Syn. Meth. Av., p. 120. Type *L. Hoieri* Ray, (fide Bryant).
Lomvia, Brandt, Bull. Acad. St. Pet. ii, 1837, p. 345. Type *Colymbus troille* Linn.
Cataractes, Moehring, Gen. Av. 1752, p. 68, No. 75. Based on *Lomvia Ins. Farræ Hoeiri*.
Cataractes, Bryant, Monog. Gen. Cataractes, Pr. Bost. Soc. Nat. Hist. 1861. Type *Colymbus troille* Linn.
Alca, Linnæus, Syst. Nat. i, 1758, in part; and of many older authors. Also of Schlegel (1867), in part.
Uria, Brisson, Orn. ii, 1760, p. 377, in part; and of authors generally.
Colymbus. Linnæus, Syst. Nat. i, 1766, in part; and of many older authors.
Cepphus, Pallas, Zoog. R.-A. ii, 1811, p. 345, in part.

Bill shorter than the head, longer than the tarsus, straight, or slightly decurved, usually very slender, much compressed, culmen regularly decurved in its whole length, rictus moderately and very gradually decurved, gonys straight, or even slightly concave in outline, very long, nearly as long as the culmen; a groove in the side of the upper mandible near its tip; commissural edge of upper mandible greatly inflected. Nasal fossæ scarcely apparent, fully feathered, the nostrils wholly obtected by feathers. Feathers on side of lower mandible retreating in a straight line obliquely upwards and backwards from interramal space to rictus. Wings moderately long; tail exceedingly short, the latter contained about three and two-thirds times in the length of the former from carpus to end of longest primary; tail much rounded. Tarsus much compressed, posteriorly and laterally reticulate, anteriorly scutellate, much shorter than the middle toe and claw. Outer and middle toes about equal in length; the claw of the latter much larger than that of the former; tip of inner claw reaching base of middle one. Claws compressed, moderately arched, acute, the outer one not grooved on its outer face, the middle one greatly dilated along its inner edge. A furrow in the plumage behind the eyes.

The genus as here constituted is restricted so as to comprehend only *troile* and the species intimately related. It differs from *Uria* proper in several points, some of them of decided importance. For the benefit of those who may be sceptical regarding the propriety of separating the two forms as genera, their distinctive characters are here antithetically tabulated:

URIA (*grylle*).	LOMVIA (*troile*).
Bill about equal to the tarsus; moderately compressed.	Bill much longer than the tarsus; much compressed.
Rictus straight, except just at tip.	Rictus decurved for great part of its length.
Gonys straight, half as long as culmen.	Gonys concave, nearly as long as culmen.
Upper mandible not grooved.	Upper mandible grooved near the tip.
Tomial edges of upper mandible scarcely inflected.	Tomial edges of upper mandible much inflected.
Nasal fossæ wide, deep, mostly naked; nostrils partially covered with feathers.	Nasal fossæ narrow, shallow, feathered; nostrils covered with feathers.
Feathers on side of lower mandible forming a salient rounded outline.	Feathers on side of lower mandible in a straight oblique line.
Tail short, slightly rounded, contained $2\frac{2}{3}$ times in the wing,	Tail very short, much rounded, contained $3\frac{2}{3}$ times in the wing.
Tarsus entirely reticulate.	Tarsus anteriorly scutellate.
Tarsus scarcely shorter than middle toe without claw.	Tarsus much shorter than middle toe without claw.
Outer face of outer claw grooved.	Outer face of outer claw not grooved.
Size moderate; no postocular furrow in the plumage.	Size large; a postocular furrow in the plumage.

Species—(4 ?).

I. Depth of bill opposite nostrils not more than a third of the length of culmen.
- No white on sides of head; bill slender, not dilated at base; culmen, rictus and gonys much curved.......... 1. *troile.*
- A white ring and line on sides of head; bill as in *troile* .... 2. *ringvia.*
- No white on sides of head; bill stout, dilated at base; culmen, rictus and gonys nearly straight.................. 3. *californica.*

II. Depth of bill opposite nostrils more than a third of the length of culmen.. 4. *svarbag.*

LOMVIA TROILE, (*Linn.*) *Brandt.*

Lomvia Hoieri, Ray, Syn. Meth. Av., p. 120; fide Bryant.
Uria major, Ger. i, p. 549; fide Bryant.
Plautus rostro larino, Klein. Av., p. 146, No. 2; fide Bryant.
Colymbus troille, Linnæus, "Fn. Suec., ed. of 1761, No. 109." Idem, Syst. Nat. i, 1766, xii ed. p. 220; not *Uria troille*, Brünn., which is *Alca lomvia*, Linn.,

1758. Gmelin, Syst. Nat. i, pt. ii, p. 788, p. 585; quotes *lomvia* of Brünnich, No. 108. Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 874; confuses the quotations of several species: *e. g.*, quotes *Uria troile*, Lath., and *Alca lomvia* of Linnæus' tenth edition.

Uria troile, Latham, Ind. Orn. ii, 1790, p. 796, No. 1. Retzius, Fn. Suecica, p. 149. Nilsson, Ornith. Suec. 1821, ii, p. 142. Temminck, Man. Orn. ii, 1820, p. 921. Selby, Illust. Brit. Ornith. ii, 1834, p. 420. Reinhardt, Natur. Bidrag, p. 18, No. 87. Gould, B. Eur. v, 1837, pl. 396. Fleming, Hist. Brit. Anim. p. 134. De Kay, N. Y. Zool. 1844, Birds, p. 279. Gray, Genera Birds, iii, 1849, p. 644. Naumann, Naturg. Vög. Deutsch. ix, 1847, pl. 331. Peabody, Rep. Nat. Hist. Mass. Birds, p. 399; confuses *troile* and *ringvia*. Thompson, Nat. Hist. Ireland, iii, 1851, p. 207. Macgillivray, Hist. Brit. Birds, ii, 1852, p. 318. Bryant, Pr. Bost. Soc. N. H. May, 1861, p. 74.

Uria (*Lomvia*) *troile*, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 345. Bonaparte, Consp. Gav. Comptes Rendus, 1856, xlii, p. 774.

Catarractes troille, Bryant, Monog. Genus *Cat.* in Pr. Bost. Soc. N. H. 1861, p. 6, fig. 2*a*. Verrill, Proc. B. S. N. H. Oct. 1862, p. 143. Idem, Proc. Essex Inst. iii, 1863, p. 160.

Uria lomvia, Brünnich, Orn. Bor. 1764, p. 27, No. 108; quotes *Alca lomvia*, Willoughby, t. 65. Not *Alca lomvia*, Linn., 1758. Scopoli, Bemerk. Naturg. i, 1777, p. 88, No. 108; fide Donndorff. Keyserling and Blasius, Werbelth. Europ. 1840, p. 238.

Uria (*Cataractes*) *lomvia*, Cassin, Baird's B. N. A. 1858, p. 913. Coues, Pr. A. N. S. Phila. Aug. 1861, p. 256. Boardman, Pr. B. S. N. H. 1862, p. 131.

? *Cepphus lomvia*, Pallas, Zoog. R.-A. 1811, ii, p. 345; quotes *lomvia*, No. 108, of Brünnich, as ♂, and *svarbag*, No. 110, of Brünnich, as ♀; also quotes *Col. troile* of Linnæus' 12th edition. Perhaps really refers to *californicus*.

Alca lomvia, Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 15. (Not of Linnæus.) Ex parte. Author considers the present and the succeeding species to be varieties of one and the same species. Describes both under same name. Quotes *Uria lomvia* et *swarbeg* [lege svarbag] of Brünnich; *Colymbus troile* of Linnæus; and *Uria rhingvia* [lege ringvia] of Brünnich.

Colymbus minor, Gmelin, S. N. i, pt. ii, 1788, p. 585; confuses three species by describing *troile*, and quoting Brünnich's No. 110 (*svarbag*) and Brünnich's No. 111 (*ringvia*). Donndorff, Beytr. Zool. ii, pt. i, p. 873; confuses three species, by quoting Latham's var. B and Brünnich's Nos. 110, 111. Author's var. γ is true *ringvia*.

Uria minor, Stephens, Shaw's Gen. Zool. xii, 1824, p. 246, pl. 63; erroneously quotes *svarbag*, Brünn.

European and American coasts and islands of the North Atlantic, to or beyond 80° N. On the American coast, breeds from Nova Scotia northward. "Its most favorite breeding-places south of the Straits of Belle Isle, are the Funk Islands, off the coast of Newfoundland, Bird Rock, near the Magdalen Islands, in the Gulf of St. Lawrence, and a number of small islands, generally called Murre Rocks, between Meccatina and the Esquimaux Islands, on the north shore of the Gulf," (Bryant). In winter to the extreme southern coast of New England. Specimens in all American cabinets.

Adult, summer plumage.—Head and neck all around rich dark brown, which changes on the back of the neck into dark slaty-brown, the color of the rest of the upper parts. This hue is nearly uniform, but most of the feathers of the back and rump have usually just appreciably lighter and more grayish-brown tips. Secondaries narrowly, distinctly tipped with pure white. Exposed portion of primaries dusky blackish, the shafts of the few outermost, and the greater part of the inner webs of the whole, lighter (more grayish-brown), tending to grayish-white towards the bases. Under wing coverts mostly white, variegated with dusky along the edges of the wing, and the greater coverts mostly of this latter color. Entire under parts from the throat pure white;

the whole length of the sides under the wings streaked with dusky or slaty-brown. Bill black; mouth yellow; iris brown; legs and feet blackish.

Adult, winter plumage.—As before; the rich brown of the head darker in hue, and more like the rest of the upper parts; the white of the under parts extending to the bill, upon the sides of the head to or slightly above the level of the commissure, upon the side of the neck so far around as to leave only a narrow isthmus of dark color, which is somewhat interrupted by white mottling. The white shades gradually into the darker color, without a trenchant line of demarcation, and varies greatly in its precise outline. Usually a pretty well defined spur of dark color runs out backwards from the eye into the white of the sides of the occiput, the spur occupying the borders of the postocular furrow in the plumage. On the sides of the lower neck, just in advance of the wings, the dark color extends in a point further than it does higher up, showing the extent of the dark brown of the summer vesture.

Young, of the first winter, are colored precisely like the adults, but may be always distinguished by their much shorter and slenderer bills, which are in great part light colored (yellowish). The feet are also much tinged anteriorly with yellowish.

Fledgelings are brownish-dusky, the breast and abdomen white; and with a few dull whitish streaks upon the head and hind neck.

Dimensions.—*Adult.*—Length about 17·00; extent 30·00; wing 8·00; tail 2·25, tarsus 1·40; middle toe and claw 2·10; inner do. 1·70; outer do. 2·00: bill along culmen 1·75, along rictus 2·50; along gonys 1·15; depth at base ·55; width at same point .30. Bill of young, first winter: culmen 1·50; rictus 2·25; gonys ·90; depth at base ·45; width at base ·25.

This species is well known to vary to a certain degree in size, and in the precise shape of the bill. The dimensions above given represent very nearly the average of a large suite of specimens measured. In colors, the variations, though considerable, are unimportant, consisting in the difference in shade of the colors of the upper parts, and the difference in precise outline of the dark and light colors about the head and neck, in summer as well as in winter specimens. Specimens just before the renewal of the feathers have the upper parts distinctly barred or waved with gray, owing to the fading of the tips of the old feathers; and the wing and tail feathers light dull gray. The difference in intensity of coloration depends chiefly upon season, though individual peculiarities may be observed. Very highly plumaged birds have the upper parts almost uniform in hue.

The synonymy of this species is very extensive, and somewhat intricate, though it is possible to collate it with much accuracy and certainty, provided more labor be bestowed than the importance of the matter warrants, as seems to the writer to have been the case in the present instance. In consequence of the peculiarly obvious nature of the characters which distinguish the several closely allied species from the present one, even the brief diagnoses of the most antiquated authors may be recognized and identified, in the majority of instances. But it is curious to note that the various names most in vogue for two or three species of this genus have been so frequently interchanged, and so variously applied, not only in a specific, but in a generic, sense, that they have really come at last to mean nothing more than simply Murre or Guillemot. It is absolutely necessary to refer to a writer's description, or his authorities quoted, before we can have any idea to what species he alludes under any given name;—certainly a very discouraging state of affairs, and one not placing ornithology in a very creditable light.

The present species is Linnæus' *troille*, of Fn. Suec. 1761, and S. N. 1766, and is so regarded by most writers. It is the *lomvia* of Brünnich, which name is usually adopted by those writers who date Linnæus' prerogative of priority at 1766. It is *minor* of Gmelin, who to a description of this species adds the synonyms of two others. It is not *troille* of Brünnich, nor *lomvia* of Linnæus.

LOMVIA RINGVIA, (*Brünn.*) *Brandt.*

Uria ringvia, Brünnich, Orn. Bor. i, 764, p. 28, No. 111; "linea a cantho oculi exteriori per latera capitis nigrantia decurrit alba." Reinhardt, Bidrag. Naturg. p. 18. Naumann, Naturg. Vög. Deutsch. xii, 1847, p. 360, pl. 332. Keyserling and Blasius, Wirbelth. Europ. 1840, p. 238. Gray, Genera Birds, 1849, iii, p. 644. Bryant, Proc. B. S. N. H. 1861, p. 74.

Uria (*Lomvia*) *ringvia*, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 345. Bonaparte, Tabl. Comp. Pelagiens, Comptes Rendus, 1856, xlii, p. 774.

Uria (*Cataractes*) *ringvia*, Cassin, Baird's B. N. A. 1858, p. 914. Two of the specimens enumerated belong to *californica*, Bryant. Description that of true *ringvia*. Boardman, Proc. B. S. N. H. Sept. 1862, p. 131.

Catarractes ringvia, Bryant, Monog. Gen. *Cat.* in Pr. Bost. Soc. N. H. 1861, p. 8, fig. 2. Verrill, Pr. B. S. N. H. 1862, p. 143. Id., Pr. Ess. Inst. iii, 1863, p. 160.

Uria alga, Brünnich, Orn. Bor. 1764, p. 28, No. 112. Ringviæ "simillima, exceptis rectricibus totis nigris."

Columbus langvia, "Plaff, Reise n. Isl. p. 562;" fide Bryant.

Colymbus troile, var. β, Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 875; quotes Brünnich's No. 112 (*alga*), and Latham's, No. 1, var. γ (also *alga*).

Colymbus troile, var. γ, Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 876. "Colymbus annulo oculorum et linea pone oculos albis." Quotes Müller, Zool. dan. Prod. p. 19, No. 152*a*.

Uria lachrymans, La Pylaie. "Choris, Voyages Pitt. autour du monde, 23;" fide Bryant. Yarrell, Brit. Birds, iii, p. 351. Temminck, Man. iv, p. 574. Gould, B. Eur. v, 1837, pl. 397. Macgillivray, Hist. Brit. B., ii, 1852, p. 326.

Uria leucopsis, Brehem, "Vög. iii, p. 880."

Uria leucophthalmos, Faber, Isis v. Oken, 1824, p. 146. Thompson, Nat. Hist. Ireland, iii, 1851, p. 211.

Uria troille leucophthalmus, Faber, Prod. Isl. Orn. 1822, p. 42.

Uria troile, Bonaparte, Synopsis, 1828, p. 424. Two species confused. Not *Colymbus troille* Linn., nor *Uria troille* Brünn. Audubon, Orn. Biogr. 1835, iii, p. 142, pl. 218, fig. 1; oct. ed. vii, pl. 473, fig. 1. Figure 2 represents *troile*, of which the author considers the present species to be the adult. Giraud, Birds Long Island, 1844, p. 376.

American and European coasts and islands of the North Atlantic. On the American coast, breeds in the Gulf of St. Lawrence; in winter ranges south to the southern extremity of New England. Habitat the same as that of *troile*, with which it is usually found in intimate association. Spec. in Mus. Acad. Philada., Mus. Smiths. Inst., Cab. G. N. Lawrence.

Absolutely identical with *L. troile*, except in having a white ring around, and white line behind, the eye. The white ring occupies the margins of both eyelids, forming a perfect circle, posteriorly continuous with the white line which occupies the furrow in the plumage, and is an inch or more long.

The changes of plumage of this species, and the individual differences to which it is subject, are absolutely identical with those of *L. troile*. The white ring and line are usually, if not always, present in winter specimens.

The white ring and line are said to be sometimes wanting. But specimens without this character cannot be distinguished from *L. troile*.

None of the specimens contained in American museums offer any grounds for contradiction of the preceding statements.

Such being the facts in the case, each one must be allowed to determine for himself the relationship of *L. ringvia* to *L. troille*, according to the notion he may entertain of species. In forming an opinion, the facts must be borne in mind that the two kinds of Guillemots are always found intimately associated, and that they are known to copulate with each other.

It is probable that the peculiar character upon which the species rests is an individual peculiarity, not a specific difference.

This bird appears to have been first described and named by Brünnich under the designation *ringvia*. *Alya* of this author is the same bird without white tips to the secondaries. Subsequently several names have been proposed, as will be seen by the synonymy adduced; each based upon the head-markings. The bird has also frequently been described as *troile*, var.

LOMVIA CALIFORNICA, (*Bryant*,) *Coues*.

? *Cepphus lomvia*, Pallas, Zoog. R.-A. ii, 1811, p. 345, synon. excl.
Uria troile, Newberry, Pacific R. R. Rep. vi, pt. iv, 1857, p. 110. Not of authors. (Coast of California)
Uria Brünnichii, Heermann, Pacific Rr. Rep. x, 1859, Route to California, Birds, p. 75: synon. excl. Not of authors. (Farrallone Islands.)
Catarractes californicus, Bryant, Monogr. Gen. *Cat.* Pr. Bost. Soc. N. H., 1861, p. 11, figs. 3 and 5. (Farrallone Islands, coast of California.)

Pacific coast of North America. Farrallone Islands, coast of California; breeding; (Mus. Smiths. Inst. and Cab. H. Bryant; the types of the species:) Sitka, Russian America; wintering; Mus. Smiths. Inst.)

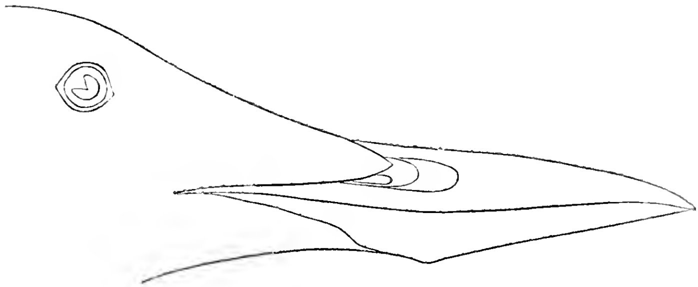

Fig. 16.—*Lomvia californica*, (Bry.) Nat. size.

(No. 17404, Mus. Smiths. A type of the species.) Entirely like *troile*, except in the form of the bill. Bill somewhat longer than that of *troile*, on an average; deeper at the base, less decurved towards the tip, the several outlines straighter. Culmen straight to near the tip, then moderately deflexed; rictus almost perfectly straight in its entire length, the commissural edge of the upper mandible toward its base somewhat expanded and everted, as in *svarbag*, though not to the same degree; the feathers on the side of the upper mandible not covering the tomial edge until very near the angula oris; gonys perfectly straight and very long, with a corresponding shortness of the mandibular rami; the angle at symphysis prominent, acute. "Iris white," (collector's label.) Length 16·00; extent 27·00, (label;) wing 8·00; tail 2·25; tarsus 1·40, middle toe and claw 2·25, outer do. 2·10, inner do. 1·70; bill along culmen 1·90, along rictus 2·90, along gonys 1.30; its depth at angle of gonys ·60, its width opposite base of nostrils ·35.

Winter plumage.—(No. 46522, Mus. Smiths. Sitka, Nov. 1866.) In this specimen the bill is shorter (1·75 along culmen) than in the type above described, and the culmen and rictus are more decurved. The peculiar shape, however, is still preserved, the lower mandible being deep and very prominent at the eminentia symphysis. The bird is probably one of the first winter. The plumage is entirely parallel with that of *troile* at the corresponding season. The upper parts are fully as dark as in the average of winter specimens of the latter species. The white of the under parts extends to the bill, and along the edge of the under mandible and eyes. Further back it invades the sides of the occiput and nape, where it is separated from the white of the throat by a prominent well defined spur of dark color protruding from the eye.

As stated by Dr. Bryant, the dark parts of this species are rather paler in tint than the average of those of *troile*. But this is not a diagnostic feature, for it does not hold good in perhaps even a majority of instances. The iris, according to the label, is white; but Dr. Bryant remarks that he can hardly credit this; though if constant it would be a strong character. The only reliable diagnostic features are found in the shape of the bill, as just described. In spite of the moderate amount of individual variation to which the bill is subject, it always preserves its peculiar shape, which is sufficiently different from that of *troile* to attract attention without direct comparison of specimens. One feature which appears to have escaped Dr. Bryant's attention lies in the inflation and eversion of the basal portion of the tomia of the upper mandible, and their comparatively scanty feathering. This is an approach towards the peculiar character of *svarbag*, though by no means attaining such development as in that species. It is readily appreciable in amount in the majority of specimens.

It is worthy of note, that the peculiarities of bill which characterize this species as compared with *troile*, are very much the same as those found in the bill of *U. columba*, as compared with *U. grylle*.

It is also to be observed, that the *ringvia* style of Murre has not been found on the Pacific coast. Should the probability of its non-occurrence become a certainty, the obvious inference would be additional evidence in favor of the specific distinction of *californica*.

Numerous examples of this species are in the Smithsonian Museum, among them Dr. Bryant's types. The bird breeds much further south than its Atlantic representative, occurring in summer on the coast of California.

Among the specimens enumerated in the "Birds of North America" by Mr. Cassin, under head of *Uria ringvia*, are two examples of this species, from California. It is possible that this species rather than *troile* is alluded to by Pallas under the name of *Cepphus lomvia*.

The figure is not a very good representation, the culmen and gonys not being straight enough. The under mandible, however, is well delineated.

LOMVIA SVARBAG, (*Brunn.*) *Coues.*

Alca lomvia, Linnæus, Syst. Nat. Ed. x, 1758, p. 130, No. 4. "Rostro lævi oblongo, mandibula superiore margine flavescente."

Uria lomvia, Bryant, Proc. Bost. Soc. N. H., May, 1861, p. 75. Not of authors, which is generally applied to *troille* Linn.

Catarractes lomvia, Bryant, Mon. Gen. *Cat.* in Pr. B. S. N. H. 1861, p. 9, figs. 1 and 4. Verrill, Proc. Essex Inst. iii, 1863, p. 160.

Uria troille, Brünnich, Orn. Bor. 1764, p. 27, No. 109. "Rostro latiore et breviore, cujus margines, etiam in exsiccatas exuviis, flavescunt." Not *Colymbus troille* Linn.

Uria svarbag, Brünnich, Orn. Bor. 1764, p. 27, No. 110. Winter plumage.

Cepphus arra, Pallas, Zoog. R.-A. ii, 1811, p. 347.

Uria arra, Keyserling and Blasius, Wirb. Europ. 1840, p. 237. Cassin, Pr. A. N. S. Phila. 1862, p. 324. (Northwest coast of America.) Naumann, Naturg. Vög. Deutsch. xii, 1847, p. 536, pl. 333.

Uria (*Lomvia*) *arra*, Bonaparte, Tabl. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774.

Uria (*Cataractes*) *arra*, Cassin, Baird's B. N. A., 1858, p. 914.

Ulca arra, Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 16.

Uria Brünnichii, Sabine, Trans. Linn. Soc. xii, 1818, p. 538. Temminck, Man. Orn. 1820, ii, p. 924. Bonaparte, Synopsis, 1828, p. 424. Nuttall, Man. Orn. ii, p. 529. Temminck, Man. Orn. ii. p. 576; p. 924. Reinhardt, Natur. Bidrag. p. 18, No. 88. Yarrell, Brit. Birds, p. 348. Swainson and Richardson, F. B. A. 1831, ii, p. 477. Gould, Birds Europ. v, 1837, pl. 398. Audubon, Orn. Biog. iii, 1835, p. 336, pl. 345; oct. ed. vii, pl. 472. Peabody, Rep. Nat. Hist. Mass. Birds, 1840, p. 400. Gray, Gen. Birds, iii, 1849,

p. 644. Thompson, Nat. Hist. Ireland, iii, 1851, p. 213. Macgillivray, Hist. Brit. Birds, ii, 1852, p. 314.

Uria (Lomvia) Brünnichii, Brandt, Bull. Acad. St. Petersb. 1837, ii, p. 345.

Uria Francsii, Leach, Trans. Linn. Soc. xii, 1818, p. 588. Stephens, Shaw's Gen. Zool. xii, 1824, p. 243, pl. 62, fig. 2. Giraud, Birds Long Island, 1844, p. 377. DeKay, New York Zoolog. Birds, 1844, p. 280. Peabody, Rep. Birds Massachusetts, p. 400.

Uria polaris, Brehm.

Coast of the North Atlantic and Pacific, and of the Arctic Seas. Herald Island, (Mus. Smiths.) In winter, on the American coast south to New Hampshire, (author's Cabinet) and New Jersey, (Mus. Acad. Philada.) Breeds in the Gulf of St. Lawrence, (Bryant.)

Form subtypical of the genus. Bill short, hardly exceeding the tarsus in length of culmen, very stout, wide and deep at the base; culmen curved in its whole length; rictus straight for about half its length, then much deflexed; gonys long, its outline decidedly concave; mandibular rami short, eminentia symphysis very prominent; tomial edges of the upper mandible in their basal half turgid, and entirely bare of feathers. Slightly larger, and rather more robustly organized than *troile*. In other respects of form identical with *troile*; the plumage and its changes also the same. The turgid portion of the tomia of the upper mandible flesh colored in life, becoming yellowish in the dried state.

Length 18·00; extent 32·00; wing 8·50; tail 2·25; tarsus 1·25, middle toe and claw 2·10, outer do. 1·90, inner do. 1·60, bill along culmen 1·40, along rictus 2·20, along gonys ·90, depth at eminentia symphysis ·55, width at base of nostrils ·30, at angula oris ·80.

The peculiar shape of the bill strongly characterizes this species. It is a rather more robust bird than *troile*, and upon an average a little larger. The colors of the plumage are not very appreciably different; perhaps slightly darker, and tending a little more decidedly towards a slaty or plumbeous hue, particularly in winter. The seasonal changes are precisely the same. The only decided difference in color lies in the whitish or yellowish hue of the expanded tomia of the upper mandible.

Brünnich's Guillemot appears to be the most boreal species of the genus, frequenting the Arctic seas, as well as more temperate latitudes. At the same time it has been found further south in winter, on the Atlantic coast of North America, than the other species; and is of frequent occurrence on the United States coast at that season. It is also of constant occurrence in the North Pacific.

This is unquestionably the *Alca lomvia* of Linnæus, 1758. The name should stand for the species, were it not now in use for the genus. It has been more usually employed for *troile*. The *troile* of Brünnich is unmistakeably this species, but is preoccupied by its Linnean application for the common species. *Svarbag*, Brünnich, comes next in order. This is based upon the winter plumage, and must stand as the specific designation of the bird. Pallas named it *Cepphus arra* in 1811; and Sabine renamed it *Uria Brünnichii* in 1818. Both these names, but particularly the latter, are in very general employ at the present day. *Francsii* of Leach, 1818, also this species, has never had much of a run with writers.

List of BIRDS collected in Southern Arizona by Dr. E. Palmer; with remarks.

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

Dr. Palmer has kindly transmitted to me a list of the birds collected by him at Camp Grant, about sixty miles east of Tucson, Arizona, during the present year. The species are identified by Prof. Baird. The collection contains four species (marked with an asterisk in the following list) not previously accredited to the Territory. Although by no means a complete exponent of the birds of Southern Arizona, the list is valuable in clearly indicating some differences between the avifaunas of the southern desert and northern mountainous portions of the Territory. Compare the species mentioned below with those characterizing the Fort Whipple fauna, as elucidated in my "Prodrome," Pr. A. N. S. Phila. Jan. 1866.

In my "Prodrome," 245 species are enumerated; one of which (*Certhiola flaveola*) was inserted by mistake. The present collection raises the number to 248. The various species mentioned passim in my paper as of probable occurrence, will, when substantiated as inhabitants of the Territory, further increase the number to about 260.

Some manuscript notes with which Dr. Palmer has favored me are placed in quotation marks. Species known to occur throughout the Territory are in small capitals; others in italics.

CATHARTES AURA, Linn.

FALCO SPARVERIUS, Linn.

ACCIPITER COOPERI, Bonap.

"Nesting, June 1st, in crotches of cottonwood trees along river bottoms."

AQUILA CANADENSIS, Linn.

One of the southermost localities on record for this species.

Geococcyx californianus, Less.

Chiefly southern and western Arizona. Rare or casual at Fort Whipple. "Very destructive to small animals, snakes, and hard-shelled insects."

Chordeiles texensis, Lawr.

Chiefly southern and western Arizona. Not observed at Fort Whipple, where *C. Henryi* is abundant.

Centurus uropygialis, Baird.

Chiefly southern and western Arizona. Rare or accidental at Fort Whipple.

MYIARCHUS MEXICANUS, Kaup.

"Is very fond of hovering around the giant cactus, *Cereus giganteus*, when in bloom, to catch the wasps and bees. Builds a loosely constructed, flat nest, often in dwelling-houses."

SAYORNIS SAYUS, Bon.

The egg of this species, Prof. Baird writes me, is much like that of *Empidonax Traillii*. Dr. Palmer's specimens are the first ones ever obtained. "The nest was procured May 3d, from the eaves of a house. The parent birds, when alarmed, hovered about uttering plaintive cries, and returned to renew their mournful notes for several days after the invasion of their home."

Pyrocephalus mexicanus, Sclater, P. Z. S. 1859, p. 45.

Southern and western Arizona. Has not been found as high as Fort Whipple.

Atthis Costæ, Bourc.

Chiefly southern and western; perhaps to Fort Whipple.

Trochilus Alexandri, Bourc.

I included this species in my "Prodrome" (p. 20), mainly on the strength of its occurrence in the Colorado Valley, very near the river (Mojave River, *Dr. J. G. Cooper*). Dr. Palmer is, I believe, the first to detect it actually within the Territorial limits. Possibly it should be in small capitals. "Nest six feet high, in a bush, in a deep ravine."

TURDUS MIGRATORIUS, Linn.

SIALIA MEXICANA, Swains.

ANTHUS LUDOVICIANUS, Licht.

PYRANGA LUDOVICIANA, Wils.

DENDROECA AUDUBONI, Towns.

D. ÆSTIVA, Gmel.

MYIODIOCTES PUSILLUS, Wils.

Campylorhynchus brunneicapillus, Lafres.
Chiefly southern and western Arizona. "Builds between the arms of the giant cactus, and among the branches of more arborescent ones; also in the shrub called 'palo verde' by the Mexicans" (*Fouqueria?*). "A nest taken May 15th was of an elongated shape, loosely built of straws and sticks; the foundation thick, raising the eggs to the middle of the nest. The orifice in the side of the nest was small, and partially concealed by loose out-hanging materials."

SALPINCTES OBSOLETUS, Say.
Throughout the Territory, but most abundant in its warmer portions.

**Harporhynchus curvirostris*, Cab.
My remarks (Prodrome, p. 29) upon Dr. Heermann's notice of this species are to be cancelled, as not pertinent. Dr. H.'s specimen is commented upon by Baird (B. N. A. 1858, p. 352), and referred wtth a query to *H. curvirostris*. Dr. Palmer's specimens add the species to the Territory. "Rare. Builds in arborescent cactuses, a few feet from the ground. The nest is upright, with loose twigs projecting all around. Two eggs were found in one."

Vireo pusillus, Coues, Prodrome, p. 40. Baird, Review, p. 360. *V. Belli*, Cooper, (nec Aud.) Pr. Cal. Acad. Nat. Sci. p. 122.
First obtained by Mr. Xantus at Cape St. Lucas; then by Dr. Cooper at San Diego, Cal.; then by the writer at Date Creek, a little south of Whipple. The present specimens further extend its range. It should perhaps be in small capitals. Dr. Palmer has obtained the eggs.

PHÆNOPEPLA NITENS, Swains.
"Feeds upon the berries of the parasitic plant" (Arceuthobium? Phoradendron?) "which grows on the large mezquite trees. Is extremely shy, with a quick, high flight."

ICTERIA LONGICAUDA, Lawr.
"Nests in thick underbrush. Feeds upon wild currants."

Auriparus flaviceps, Sundevall.
Southern and western. Not found in the mountainous districts. "Builds upon the outer limbs of bushes along shady river banks. The weight of the nest often causes the limb to hang nearly to the ground."

CARPODACUS FRONTALIS, Say.

CHRYSOMITRIS PSALTRIA, Say.

ZONOTRICHIA GAMBELI, Nuttall.

POOECETES GRAMINEUS, Gm.

CHONDESTES GRAMMACA, Say.

MELOSPIZA FALLAX, Baird.

SPIZELLA BREWERI, Cassin.

SPIZELLA SOCIALIS, Wils.

Poospiza bilineata, Cassin.
Perhaps to be in small capitals; but certainly most abundant in southern and western Arizona. "A nest containing three eggs was built in a dwarf mezquite bush, a few inches from the ground."

Calamospiza bicolor, Towns.
I did not find this species at Fort Whipple, and have no reason to believe

that it occurs in northern Arizona, though it is found much further north (Kansas, Nebraska, etc.), along other meridians of longitude. But it is nevertheless common in the Gila Valley, and thence extends to the Pacific, though it does not reach the ocean in the latitudes of Upper California, Oregon and Washington. There is something peculiar in its distribution, not satisfactorily explained upon any hypothesis touching the climate or physical geography of the regions inhabited by it.

* *Cardinalis igneus*, Baird, Pr. A. N. S. Philad. 1859.
Not before recorded from Arizona. This is a Cape St. Lucas species, which, as I remarked (Prodrome, p. 54), was to be expected to occur in southern Arizona, though I had at that time no authority for including it in my list. Its present acquisition is a matter of much interest.

Pyrrhuloxia sinuata, Bonap.
Confined to the southern districts.

Guiraca melanocephala, Swains.
"Builds a flattish nest in crotches of young willows, a few feet from the ground."

Pipilo chlorura, Towns.

Pipilo mesoleucus, Baird.
Chiefly southern and western Arizona, but extends very near Fort Whipple. Dr. Palmer says that it nests in much the same situations as those selected by the *Icteria longicauda*.

Pipilo Abertii, Baird.
This, and the preceding species, are nearly identical in their range, and are the characteristic species of the genus in the Gila and Colorado Valleys. Will not *P. albigula* (Baird, Pr. A. N. S. Phila. 1859; from Cape St. Lucas) be hereafter detected in south-western Arizona?

Molothrus pecoris, Gm.

Agelæus ——— ?

Xanthocephalus icterocephalus, Bonap.

**Icterus cucullatus*, Swains.
An acquisition. Not previously detected in the United States, except in the valley of the Lower Rio Grande. *I. Bullockii* has been hitherto the only Oriole accredited to the Territory.

Sturnella neglecta, Aud.

Corvus carnivorus, Bartram.

Lophortyx Gambeli, Nutt.
"In early spring the Quail feed much upon mezquite seed, and the tender shoots of a certain aromatic plant. The nest, built among underbrush along the river bottoms, is merely a small shallow depression, thinly lined with soft grass, leaves and feathers. The eggs are almost exactly like those of the California Quail." (Pale buff, or yellowish-white, blotched and spotted all over with different shades of brown; of the usual shape in this family.)

Meleagris mexicana, Gould.
Generally distributed throughout Arizona and New Mexico; but rare in certain localities, and extremely abundant in others.

Ægialitis vociferus, Linn.

Fulica americana, Gmel.

Bernicla Hutchinsi, Richardson.

Querquedula cyanoptera, Vieill.

*Lophodytes cucullatus, Gmel.

Not before recorded from the Territory, though its occurrence was to have been anticipated. (Cf. Prodrome, p. 63.)

Podiceps cornutus, Gmel.

Jan. 28th.

Mr. Cassin, Vice-President, in the Chair.

Thirty-one members present.

The following gentlemen were transferred from the list of members to that of correspondents: Jos. Jones, M.D.; W. F. Reynolds, U. S. Top. Eng.

Dr. Allen's resignation as Corresponding Secretary was read and accepted.

The following Committees were elected for 1868:

Ethnology.—J. Aitken Meigs, S. S. Haldeman, F. V. Hayden.

Entomology and Crustacea.—John L. Le Conte, J. H. B. Bland, Tryon Reakirt.

Comparative Anatomy and General Zoology.—Joseph Leidy, Harrison Allen, S. B. Howell.

Ornithology.—John Cassin, Spencer F. Baird, B. A. Hoopes.

Mammalogy.—Harrison Allen, E. D. Cope, John Cassin.

Conchology.—Geo. W. Tryon, Jr., Rev. E. R. Beadle, C. F. Parker.

Herpetology and Icthyology.—Edward D. Cope, S. Wier Mitchell, Chas. Shaeffer.

Geology.—Isaac Lea, F. V. Hayden, T. A. Conrad.

Physics.—Robt. Bridges, R. E. Rogers, Jacob Ennis.

Library.—Jos. Leidy, John Cassin, Robert Bridges.

Botany.—Elias Durand, Aubrey H. Smith, Elias Diffenbaugh.

Mineralogy.—Wm. S. Vaux, S. R. Roberts, Jos. Willcox.

Palæontology.—T. A. Conrad, Jos. Leidy, Wm. M. Gabb.

Proceedings.—Joseph Leidy, Wm. S. Vaux, John Cassin, Robt. Bridges, Geo. W. Tryon, Jr.

Prof. Edw. D. Cope was elected Corresponding Secretary.

Feb. 4th.

The President, Dr. Hays, in the Chair.

Forty-one members present.

E. D. Cope made some observations on the living inhabitants of caves in south-western Virginia. He said he had examined some fifteen, which were not generally known; one of them, Spruce Run Cave, in Giles county, for a distance of 2½ miles. He said that, besides bats, the Neotoma floridanum was very abundant, and made nests like those of birds. He also found some articulates peculiar to them. The few molluscs were the same as those of the woods, and did not occur far from the mouth. The only beetle was entirely blind, being a new Anophthalmus, A. pusio of Horn, and was rare. A species of fly, apparently identical with one usually found about excrements, was found in all the localities where rats occurred. There were two species of Myriapoda, one the Cambala annulata Say, quite rare and with rudimental eyes, and the other, most common in the remote recesses only, the Pseudotremia cavernarum Cope, sp. nov. (gen. nov.) of the Lysopetalidæ, with eyes better developed.

Special Meeting, Feb. 6th.

MR. VAUX, Vice-President, in the Chair.

Twelve members present.

Dr. Ruschenberger announced the death of Mr. Jacob Gilliams, one of the founders of the Academy, on the 4th inst., in the 86th year of his age.

On motion, the meeting adjourned to attend the funeral.

Feb. 11th.

The President, DR. HAYS, in the Chair.

Thirty members present.

The following paper was presented for publication:

"Description of some new species of diurnal Lepidoptera. Series III." By Tryon Reakirt.

Mr. Vaux, on behalf of Dr. Ruschenberger, offered the following resolutions, which were adopted:

Resolved, That in the death of Mr. Jacob Gilliams, at an advanced age, the Academy has lost the latest survivor of its seven founders and one of its oldest friends.

That the society holds in grateful remembrance his efforts to encourage the cultivation of the natural scienes at a period when they attracted the attention of few persons in Philadelphia.

That to his interest in natural history the foundation of this institution may be in a great measure justly attributed.

That the friends of the natural sciences recognize in his early labors to establish an institution devoted to the collection of materials and the publication of essays for the purpose of diffusing knowledge of the natural history of the world, a claim to their lasting respect.

That the Academy tenders to the members of his family this expression of sympathy in their bereavement; and that the President of the Academy is requested to communicate to them a copy of these resolutions suitably engrossed.

Feb. 18th.

MR. CASSIN, Vice-President, in the Chair.

Thirty-four members present.

Feb. 25th.

The President, Dr. Hays, in the Chair.

Twenty-six members present.

The deaths of the following gentlemen were announced: Marcel de Serres, Tobias Wagner, and Gen. Geo. A. McCall.

The following gentlemen were elected members: Stephen Morris, Thos. T. Tasker, Jr., Stephen P. M. Tasker, Henry G. Morris, Jas. E. Caldwell and C. Newlin Peirce.

On favorable report of the Committee, the following paper was ordered to be published:

Descriptions of some new species of Diurnal LEPIDOPTERA.

Series III.

BY TRYON REAKIRT.

51. Lycæna marina, nov. sp.

Male. Upper surface lustrous violet blue, edged with a narrow black line; usually towards the anal angle there are two rounded black spots; these are, however, sometimes obsolete; fringe white; expanse ·8—1 inch.

Underneath soiled white; fore wings' costa, brown; from the base, five transverse bands extend across the wing from the costa to the inner margin; the fourth and fifth are sometimes interrupted on the second median veinlet; a sixth runs down from the costa to the same nervule, and a seventh and narrower one reaches only the third nervule; following these there is a submarginal row of connected lunalæ, enclosing oblong darker brown dashes between themselves and the margin.

Upper half of secondaries traversed by numerous brown lines, commonly six in number, always interrupted in different points, and dilated and compressed irregularly; then there is a soiled white submesial band; and then the series of lunulæ, dashes and spots as on the fore wings, rarely confluent; the two spots nearest the anal angle are jet black, irrorated with shining green atoms; and ringed with ochreous-yellow.

Body black above, clothed with bluish hairs, whitish beneath; antennæ black with whitish annulations.

Female. Upper surface white, glossed with violet blue at the base; costa of both wings and outer margin of the primaries broadly brown; the white area of the fore-wings is traversed by three maculate brown belts; one subbasal, the second mesial, the third subapical and merging into the brown border.

Across the disc of the secondaries are several brown rays, and a submarginal lunulate brown line encloses a marginal series of large rounded brown spots, of which the second from the anal angle is always the largest and deep brown or black.

Underneath marked as in the *male*, but with much less intensity; the lower portions of the transverse bands of the fore wings are frequently obsolete; on both wings they are narrower and less compact, thus increasing the white spaces; the submarginal lunulæ and spots, as in the males, wanting sometimes the ochreous yellow rings. Expanse ·87—1·05 inches.

Hab.—Orizaba, Mexico. (Coll. Tryon Reakirt.)

"Mexico, near Vera Cruz." Wm. H. Edwards.

Allied to *Lycæna Cassius*, Cram.

52. Goniloba dolores, nov. sp.

Upper surface clear brown, with olive brown hairs below the median nervure of the primaries towards the base, and over the basal half of the secondaries. Four translucent ochreous spots on the primaries; the first large and near the end of the cell, is of trapezoidal form, with an angular indentation upon the outer side; the second, also trapezoidal, but less than the preceding, is contained within the second and third median veinlets, and situated midway between the first and the outer margin; the third, resembling an irregular right-angled triangle, is aligned on the first median veinlet, with the second and fourth, which last is small and obovate, placed on the submedian vein just beyond its middle; a curved ash-gray bar, widest centrally, and tapering at either end, extends between these last spots and the cell from the submedian vein to the second median veinlet, touching above the upper angle of the third spot, and below the inner portion of the ovoid.

Secondaries immaculate; fringe ochreous yellow, lightly cut with brown; expanse 2·13 inches.

Underneath, the primaries have an ash brown apical triangular patch, separated by a brown bar from an irregular purplish ashy belt, extending from the margin down to the second translucent spot, and which contains a darker spot near the middle of its inner margin; the costa between this belt, and a pale ochreous spot resting thereon, above the translucent spot in the cell, is reddish brown; the fourth spot of the upper surface is covered by a large pale yellow ovoidal spot; the ashy bar is wanting.

Secondaries pale purplish brown, with darker velvet maroon brown shades, formed into three prominent areas, viz., a broad border, a large central patch, and another resting on and below the middle of the costa; there are also two basal bars and a series of connected lunulæ between the central patch and the marginal band. Antennæ brown; club ochreous beneath.

Hab.—"Mexico, near Vera Cruz." Wm. H. Edwards.

53. Pyrgus Georgina, nov. sp.

Upper surface black, with ashy shades, and waved brown lines traversing the surface. Primaries: a white spot occupies the middle of the cell; beyond a mesial white band, broken into two parts, of which the lower occupies the central portion of the first median interspace; the upper extends from beyond this to the costa; on the margin, midway between this band and the apex are two small white spots; there is an indistinct series of submarginal black spots, each having a minute whitish or gray point, sometimes enlarging into an enclosing crescent, attached to its outer extremity.

Secondaries: a broad mesial band, bifid on the costa; below, a sinuated irregular line; both white; a submarginal series of indistinct spots. Fringe brown, white towards the anal angle; expanse 1·25—1·5 inches.

Below, primaries; an oblong white dash in the cell; the central band as above; an abbreviated series of three or four white spots run down from the costa, in place of the two on the upper surface; along the outer margin a series of large white oblong dashes, becoming brownish towards the apex, and containing each a rounded dark brown spot—in the lowest, the spot is geminate.

Secondaries white, or soiled white, more or less brown towards the base; a subcentral maculate row of brown spots, of which three or four are contiguous, towards the abdominal margin, and two distinct ones nearer the costa; along the outer margin are connected lunulæ, rarely coalescing with the spots of the inner row.

Body above black; the rings of the abdomen marked with whitish hairs, underneath white; palpi white, excepting the terminal article, which is black. Antennæ brown, with incomplete white annulations, club tipped with ferruginous.

Hab.—"Mexico, near Vera Cruz." Wm. H. Edwards.

Dedicated to my cousin, Mr. Geo. W. Tryon, Jr., the distinguished Conchologist, as a slight acknowledgement of his unvarying kind assistance in my studies.

54. CIRROCHROA TYCHE, Felder.

♂ Felder, Wiener, Entom. Monatschr. v, p. 301, n. 13, (1861.)

Female. Upper surface ochreous brown; a broad pale belt crosses the outer half of the forewings, bordered interiorly by a gradually diminishing waved dark brown bar, broadest below the subcostal vein, and becoming obsolete towards the inner margin; the outer margin is dark brown, interior to which are two angulated transverse lines, the outer being brownish black and complete, the inner brownish ochreous, and obsolete in its lower portion; three indistinct brownish spots arise from the inner margin in the pale belt, decreasing in size upward.

On the secondaries the transverse belt is suffused with the ochreous ground color, and contains six rounded or oval black spots—there being none in the discoidal interspace; the anterior narrow black line, and the posterior lunulate or angulated lines,—three of these on the hind wings,—are all complete, extending from the costal to the abdominal margin, and anal angle.

Underneath pale ochreous, the markings of the upper surface repeated in pale shades; the outer half of the wing glossed with lilacine; a continuous lilaceous band underneath the mesial brown line. Expanse 2·75 inches.

Antennæ black, bright ferruginous underneath, and upon the club.

Hab.—Mindoro. (*Dr. Chas. Semper.*) (Coll. Tryon Reakirt.)

I am indebted for this beautiful species, along with many other rarities, to Mr. Georg Semper, brother of the celebrated collector.

55. PAPILIO BURTONI, nov. sp.

Size and shape of *Pap. Leucaspis*, Godt.

Male. Upper surface pale greenish yellow; a very broad, dark brown terminal band along the outer margin of both wings; along the interior edge of which band, on the fore wings, is a darker brown stripe, extending from the cell to the inner margin; two wide dark brown belts traverse the fore wings, both merging into the terminal border—one resting over the end of the cell, cuts off a small lunulate piece of the ground color, the other is a mesial band, running from the middle of the costa towards the inner angle.

Upon the border of the hind wings are several pair of imperfect lunes, composed of lustrous bluish gray atoms; above the anal angle a yellow lune, and above this a red lune, sometimes two of these; the brown border is continued some distance along the abdominal margin. The long slender tail terminates with a large yellowish white patch.

Underneath mainly as above; the outer border of both wings is irrorated with lilacine atoms, assuming the form of lunulæ upon the lower portion of the hind wings. Expanse 4 inches.

Head, throat and abdomen, dark brown.

Antennæ black, with bright orange brown clubs.

Hab.—Iusagasugá, New Granada. (Coll. Tryon Reakirt.)

This magnificent species was one of a large collection formed by Hon. A. A. Burton, near Bogotá, and has most appropriately been dedicated to him.

56. DIRCENNA BAIRDII, nov. sp.

Allied to *Dir. Jemima*, Hübn. Wings translucent, ochrey-yellowish, with darker semi-opaque spots and border.

Male. The fore wings are narrower and more acute than in the related species; the disposition of the pellucid spots upon these is similar to *Jemima;* their hind margin, however, is black instead of orange-orcheous; the median vein is orange to the end of the cell; all the others black.

Hind wings; the black terminal border does not extend so far upon the abdominal margin, upon which there is an orange brown patch, and is more diffused inwardly; the basal half of the wing is ochreous, as are also the veins contained therein; those upon the outer half, which is covered with the black shade, are black.

Underneath as above, with the addition of three apical silvery white spots upon the fore wings; a costal streak, three oblong apical spots, and three triangular spots along the outer margin of the hind wings, all silvery white. Expanse 2·75 inches.

Head, thorax and abdomen, above blackish brown, below the thorax is spotted with white, but *no* yellow stripes as are in *Jemima*; abdomen below yellowish. Antennæ blackish at base, orange brown beyond, darkening towards the apex.

The *female* does not differ from the male, save in the more rounded wings, and in intensity of coloration.

Hab.—Insagasugá, New Granada. (Coll. Tryon Reakirt.)

57. Mechanitis Franis, nov. sp.

Very closely allied to *Mech. Menapis*, Hewits.

Differs chiefly in the larger size of the fulvous basal area of the fore wings; in the invariable presence of a large rounded black spot, between the first and second median veins; and in the more common division of the black portion of the hind wings into a central belt, and a terminal border.

Underneath as in *Menapis*, with the above differences.

Hab.—Insagasugá, New Granada. (Coll. Tryon Reakirt.)

I can hardly believe this to be a local variety of *Menapis*; both were captured at the same place, and time, and throughout a long series of specimens I find the differences to remain constant.

58. Pyrrhopyga Bogotana, nov. sp.

Upper surface black, brilliantly glossed with steel blue; the posterior two-thirds of the outer margin of the hind wings, is bordered with bright orange brown, broadest towards the anal angle, gradually diminishing to the other extreme point, and scalloped interiorly.

Underneath the same, with perhaps less shining reflections.

Body and legs glossy blue-black, with orange-brown palpi. Antennæ black.

Expanse 2·25 inches.

Hab.—Insagasugá, New Grenada. (Coll. Tryon Reakirt.)

59. Pyrgus alana, nov. sp.

Upper surface white, faintly tinged with yellowish; costa of primaries, and a large apical patch, covering the outer two-fifths of the wing, dark brown; the latter, which is concaved interiorly, and traversed by darker brown veins, presents a transverse, indistinct, white macular, narrow subapical band, frequently entirely obsolete.

Secondaries with an irregular narrow brown border, from which brown veins rise a short distance into the area of the wing.

Fringe of primaries brown; of secondaries, first narrowly white, bordered externally with brown, forming two parallel lines around the whole outer margins.

Underneath chiefly as above, with the brown more diluted, and the white subapical band of the primaries, and the whole white surface of the secondaries, replaced with ochreous yellow; the former consists of six distinct spots, of which the two lower are the largest, and extend to the outer margin; the white basal area of the fore wings is more or less tinged with yellow.

On the secondaries, the veins are all lined with black, and there are two diffused brown patches; one below the centre of the wing and towards the abdominal margin, the other on the outer edge near its middle.

Expanse 1·70 inches.

Thorax and abdomen above black, clothed with whitish hairs; the latter, below, yellow, with a double brown stripe; head palpi, and antennæ brown; a yellow collar above the first.

Hab.—Insagasugá, New Granada. (Coll. Tryon Reakirt.)

60. Heliconius Guarica, nov. sp.

Upper surface dark brown, glossed with bluish black; anterior wings crossed by a broad central transverse scarlet band, abruptly terminating after the first median veinlet, and not touching the outer margin; posterior, immaculate.

Underneath, the band becomes pale rosy white, edged only with dark pink; the costa of forewings, presents a short basal scarlet bar, that of the hind wings a longer yellow one; upon these are also five basal spots, one yellow, surrounded by four scarlet ones.

Body black, with some yellow stripes on thorax below and a yellow ventral stripe; some yellow spots on the collar; first and second joints of palpi yellow; third black. Antennæ black.

Expanse 2·65 inches.

Hab.—Insagasugá, New Granada. (Coll. Tryon Reakirt.)

Closely allied to *Hl. Hydara*, Hewits, but constantly differs in the absence of a scarlet spot on the upper side of the secondaries.

In the same number (63) of his "Exotic Butterflies," he has redescribed *Callidryas Thaurama*, Reakirt, as *Call. Fiaduna;* his name must therefore be regarded as a synonym.

March 3d.

Mr. Vaux, Vice-President, in the Chair.

Twenty-three members present.

March 10th.

The President, Dr. Hays, in the Chair.

Forty members present.

The following papers were presented for publication:

"A new species of Osmerus." By Thaddeus Norris.

"Description of nine new species of Unionidæ, from Lake Nicaragua, C. A." By Isaac Lea.

"An examination of the Reptilia and Batrachia obtained by the Williams College Expedition to Equador and the Upper Amazon, with notes on other species." By Edw. D. Cope.

A letter was read announcing the death of Sir David Brewster.

The Publication Committee announced the issue of No. 4 of the Proceedings for 1867.

March 17th.

The President, Dr. Hays, in the Chair.

Thirty-three members present.

Mr. Benj. Smith Lyman made the following remarks on a bent marble stone presented by Mr. Edward Shippen to the Academy.

The bent gravestone of Dr. William Shippen, who died 11th July, 1808, and of Alice his wife, who died 25th of March, 1817, was formerly in the burial ground on Arch street, above 5th. As it had to be removed on the closing up of that ground, it was thought best to replace it by a new one, and the bent stone was given to the Academy on the 15th of November, 1867. The stone is of white Pennsylvania marble and is 6 ft. $3\frac{1}{2}$ in. long, by 3 ft. 1 in. wide and 2 in thick. It simply rested on six marble posts, without being fastened to them, except imperfectly by mortar, and must have bent merely from its own weight. The posts stood on separate brick foundations under ground, but the near (northern) middle post of the picture had sunk so as no longer to touch the slab, and the other middle post had settled also. The space between the inner sides of the end posts, lengthwise of the slab, was 4 ft. $9\frac{1}{2}$ in. The stone is bent down in the middle an inch and a half from a straight line drawn from the near right hand corner to the far left hand corner (northwest and east) and half an inch from the line drawn cornerwise the other way; and lengthwise through the middle it is bent an inch and a sixteenth from straightness.

March 24th, 1868.

The President, Dr. Hays, in the Chair.

Forty-two members present.

The following was presented for publication:

"Sexual Law in Acer dasycarpum." By Thos. Meehan.

Prof. Cope exhibited to the Academy several fragments of a large Enaliosaurian, discovered by the Academy's correspondent at Fort Wallace, Kansas, Dr. Theoph. H. Turner. Portions of two vertebræ brought east by Dr. Le Conte from his geological survey of the Pacific Railroad route, had previously indicated to the speaker the existence of an animal related to the Plesiosaurus, and the recovery of the greater part of the reptile had confirmed this affinity.

The remains consisted of over one hundred vertebræ, with numerous portions of ribs, the greater part of the pelvic and scapular arches, with two long bones somewhat like femora. Part of a muzzle, with teeth, belonged to the same animal.

The species represented a genus differing in important features from Plesiosaurus and its near allies. These were the absence of diapophyses on the caudal vertebræ, and the presence of inferiorly directed plate-like parapophyses, which took the place of the usual chevron bones, in the same position; also in the presence of chevron-like bones on the inferior surfaces of the cervical vertebræ; further in some details of the scapular and pelvic arches. The diapophyses of the dorsal vertebræ originated from the centrum, and not from the neural arch.

In generic features it was related to the Cimoliasaurus and Brimosaurus of Leidy, so far as the latter are yet known. It differed from both of them in lacking diapophyses on the lumbar vertebræ.

The general form was different from Plesiosaurus in the enormous length of the tail, and the relatively shorter cervical region. The total length of the vertebral column sent was thirty-one feet ten inches, divided as follows: caudals 18 ft. 10 in., dorsals 9 ft. 8 in., cervicals 3 ft. 4 in.; adding for missing cervicals and cranium at least 2 ft. 6 in., we have a total of $34\frac{1}{2}$ feet. An interval of three to four feet occurred between the cervicals and dorsals as they lay in the cliff from which they were excavated, which if, as is probable, it was occupied by vertebræ in the animal, would give a length of thirty-eight feet. The caudal vertebræ had very compressed centra, and elevated neural and hæmal laminæ, and were of unusually elongate form. Neural arches everywhere on the column co-ossified. All the vertebræ considerably more constricted medially than in Brimosaurus or Cimoliasaurus, and none except cervicals with such small antero-posterior diameter as the latter possess.

The general characters of the species would be presented in a special essay.

He called it ELASMOSAURUS PLATYURUS Cope, from the caudal laminæ, and the great plate bones of the sternal and pelvic regions. It was a marine saurian, whose progression was more largely accomplished by its tail than by its paddles.

The teeth and muzzle showed it to be an ally of Plesiosaurus. The former were cylindric, implanted in very deep alveolæ, and furnished with a very small pulp cavity. The exposed surface closely and sharply striate to the narrowly acuminate tip.

The beds were argillaceous, with much gypsum; the latter mineral coating the bones. The age was cretaceous; perhaps, according to Le Conte, the upper middle. The matrix beneath the dorsal vertebræ contained remains of perhaps six species of fishes, several ctenoid, among them a known Enchodus, and a Sphyraæa, to be called Sph. carinata Cope.

The complete and mounted skeleton of the fossil Irish Elk, now in the Museum, was presented to the Academy by Mr. J. A. Wright.

On motion the Academy tendered to Mr. Wright a vote of thanks for his magnificent donation.

March 31st.

The President, DR. HAYS, in the Chair.

Thirty members present.

The deaths of Mr. Thos. Earp, and Mr. C. F. Hagedorn, were announced.

On leave being granted, the following paper was presented for publication:

"On a new mineral in Cryolite, Ivigtite." By Theo. D. Rand.

The following gentlemen were elected Members:

Dr. Thomas B. Reed and Mr. Richard Peltz.

The following were elected Correspondents:

Dr. Fred'k Stoliska, of Calcutta, Maj. Geo. Clendon, Jr., of Glenn's Falls, N. Y., and Mr. R. H. Stretch, of San Francisco, Cal.

On favorable report of the Committees, the following papers were ordered to be published:

Remarks on the New Species of OSMERUS (O. Sergeanti.)

BY THADDEUS NORRIS.

At a meeting of the Academy of Natural Sciences, March 26, 1861, the writer presented "Remarks on a new species of Osmerus taken in the Schuylkill below Fairmount dam," describing its specific characteristics as compared with those of the Northern Smelt, *O. viridiscens*, also naming other rivers besides the Schuylkill in which it is found.

Although I was then well convinced of the difference between the two, those who composed the committee on Ichthyology could not admit sufficient peculiarity in this to constitute it a new species; I therefore suppressed the specific name given above, which I now renew; having no less authority than that of Professor Agassiz, who has examined and compared the one with the other. I would add that my conjectures as to the new species being found at the terminus of the tide in the tributaries of the Delaware river have proved correct; as I have since ascertained that it is taken in March in the Brandywine below the dam at the head of tide, as well as at the foot of the rapid water at Trenton, appearing for a short time before spawning and apparently only for that purpose.

My object in this communication is to establish this as a distinct fish and give it a specific appellation, as well as to settle any question of priority of description which may hereafter arise.

I have presented this evening a small vial which holds the contents of the stomach of a northern smelt, *O. viridiscens*, as being suggestive of the vast amount of fish food accessible to marine species in winter as well as in summer. The vial contains three shrimps, one of the small fry of some other fish, and a half dozen fish ova not quite as large as those of our brook trout. The ova have made no progress in the process of incubation, from which I infer that they were seized by the Osmerus as soon as they were ejected, or not long after they were deposited by the parent fish. In observing the habits of both species above referred to, I have found them to go to the head of tide, but no further, for the purpose of spawning. This occurs as soon as the rivers are free from ice in the spring, when the northern smelt is taken in such numbers from the Gulf of St. Lawrence as sometimes to be used as manure.

Description of Nine Species of UNIONIDÆ from Lake Nicaragua, Central America.

BY ISAAC LEA.

In the "Proceedings of the Acad. of Nat. Sci.," April, 1856, I described a new species of *Triquetra* (*Hyria* Lam.), which I called *lanceolata*. It was made from a single valve in a collection from China. In the diagnosis made in the Proceedings it was not mentioned that this valve was somewhat twisted, being fearful that the curved condition arose from accidental circumstances, and not from a normal condition like *Arca tortuosa*, Lin. Subsequently, in the "Journal of the Academy," vol. iii, and in "Observations on the Genus Unio," vol. vi, I published a full account of this peculiarly interesting species, having received perfect specimens, one of which was well figured. In this paper I thought that, as the original name of *lanceolata*, made from a single imperfect valve, did not apply to the perfect shell, science would be subserved by a descriptive name. I proposed to call it *contorta*, and redescribed it under that name with full remarks and observations. At that time it was the only member of the family *Unionidæ*, which was known not to be *equivalve*. Subsequently, in describing a species of *Spatha*, under the name of *Natalensis*, I mentioned that it was "slightly inequivalve." "Journal Acad. Nat. Sci.," vol. vi, and in "Observations on the Genus Unio," vol. xi.

In 1865 I published in the "Proceedings of the Academy" the diagnosis of a new *Unio* from China, which is *inequivalve* and twisted. This I named *tortuosus*. The full description and figure, with remarks, is in a paper which I have prepared for the Journal of the Academy. These constitute all the *inequivalve* species of the family which I have seen until recently.

The collection made by the late Mr. Thomas Bridges, botanist, who, during his travels in Central America, visited Lake Nicaragua, has been kindly placed in my possession, part by Col. E. Jewett, and part by Mr. W. M. Gabb, Palæontologist of the California Geological Survey. Very much to my surprise and satisfaction I found that several species of *Unio* and *Anodonta* had this *inequivalve* character.

It may be here remarked that there seems to be a predisposition, in the *Unionidæ* of Central America, to this very unusual character in the *Unionidæ*, while in Mexico, United States and Canada, where so many species have been described, there has not been a single one observed. These observations and the following list will, I hope, induce more attention to the investigation, by students of Fresh-water *Molluscs*, of this interesting branch of inquiry.

List of inequivalve Unionidæ.

Triquetra contorta, China.	Unio encarpus, Central America.
Spatha Natalensis. Africa.	Unio Nicaraguensis, Central America.
Unio tortuosus, China.	Anodonta inæquivalva, Cent. Amer.
Unio Newcombianus, Cent. America.	Anodonta Granadensis, Cent. Amer.
Unio Gabbianus, Central America.	Anodonta lenticularis, Cent. Amer.

Unio Nicaraguensis.—Testa sulcatâ, triangulari, compressa. aliquanto *inæquivalva*, inæquilaterali, postice obtuse angulata, antice oblique truncata; valvulis crassiusculis; natibus prominentibus, subacutis; epidermide olivacea, crebris sulcatis indutis, eradiata; dentibus cardinalibus erectis, compressis, crenulatis et in valvulo dextro tripartitibus; lateralibus brevibus fonicatisque; margarita argentea et iridescente.

Habitat.—Lake Nicaragua, Central America. Mr W. M. Gabb.

Unio Granadensis.—Testa sulcata, elliptica, subinflata, inæquilaterali, postice subangulari, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus; epidermide tenebroso-fusca, nigricanti, eradiata; dentibus cardinalibus parviusculis, compressis, erectis crenulatisque; margarita alba et iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Col. E. Jewett and Mr. W. M. Gabb.

Unio encarpus.—Testa sulcata, subtriangulari, subinflata. aliquanto *inæquivalva*, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis subcrassis, antice crassioribus; natibus prominentibus; epidermide tenebroso-olivacea, encarpiformi, eradiata; dentibus cardinalibus compressis, erectis, crenulatis, in valvulo dextro subtripartitibus; lateralibus obliquis rectisque; margarita albida et iridescente.

Hab.—Lake Nicaragua. Mr. W. M. Gabb.

Unio Gabbianus—Testa sulcata, triangulata, subinflata, aliquanto *inæquivalva*, inæquilaterali, postice triangulari, antice oblique truncata; valvulis crassiusculis, antice aliquanto crassioribus; natibus prominentibus, ad apices retusis; epidermide tenebroso-olivacea, obsolete radiata; dentibus cardinalibus erectis, compressis et valde crenulatis; lateralibus curtis, obliquis striatisque; margarita argentea et iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Col. E. Jewett and Mr. W. M. Gabb.

Anodonta Bridgesii.—Testa lævi, oblonga, inflata, inæquilaterali, antice et postice rotundata; valvulis pertenuibus; natibus prominulis; epidermide lævissima, micanti, olivacea, obsolete radiata; margarita elegantissime iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Mr. Thomas Bridges.

Anodonta inæquivalva.—Testa lævi, obovata, compressa, *inæquivalva*, inæquilaterali, antice et postice rotundata; valvulis subtenuibus; natibus subprominentibus; epidermide vel luteo-viridi vel tenebroso-viridi, obsolete radiata; margarita cæruleo-alba et valde iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Mr. W. M. Gabb.

Anodonta Jewettiana.—Testa lævi, suboblonga, valde inflata, inæquilaterali, postice rotundata, antice oblique rotundata; valvulis tenuibus; natibus prominentibus, inflatis; epidermide olivacea, transverse striata fere sulcata, obsolete radiata; margarita argentea et valde iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Col. E. Jewett.

Anodonta lenticularis.—Testa lævi, subrotunda, compressa, *inæquivalva*, inæquilaterali, antice et postice rotundata: valvulis subtenuibus; natibus prominulis; epidermide transverse striata, tenebroso-viridi, redundater radiata: margarita cæruleo-alba et valde iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Mr. W. M. Gabb.

Anodonta Granadensis.—Testa lævi, elliptica, subinflata, *inæquivalva*, inæquilaterali, postice obtuse angulata, antice rotunda: valvulis subtenuibus; natibus prominulis; epidermide vel lutea vel viridi-radiata; margarita cæruleo-alba et valde iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Col. E. Jewett.

An Examination of the REPTILIA and BATRACHIA obtained by the Orton Expedition to Equador and the Upper Amazon, with notes on other Species.

BY E. D. COPE.

The expedition for purposes of scientific exploration, to which the present paper relates, was undertaken during the autumn and winter of 1867—8, under the auspices of the Smithsonian Institution. Prof. James Orton, of Williams College, Massachusetts, directed the expedition, which was composed mainly of students of the same institution. This enterprise, particularly worthy of a popular institution of learning of the grade and position which an American College ought to occupy, has been attended with success in many departments of natural and physical sciences. In the present department, valuable in furnishing a reliable key to the history of the mode of creation and distribution of animal life, a considerable amount of material has been collected, which is reviewed summarily in the following pages.

The party divided, a portion ascending the Orinoco River to meet the other portion in Eastern Equador. The course of the latter was as follows, as I am informed by Prof. Orton:

They first touched the continent at Payta, Peru, and afterwards at Guayaquil; then proceeded inland over the Andes to Quito—collecting in the valley about three months; thence via Pafallacta (on the east slope of the eastern Cordillera) and Archiaona (the largest town in the Oriental part of Equador,) to Napo on the River Napo: thence by canoe down the Napo to the Maranon and Amazons.

They collected Reptiles chiefly from Guayaquil, Pallatanga (on the west slope of the western Cordillera south of Chimborazo); Ambato (in Valley of Quito); western slope of the volcano Antisana, 13000 ft. above sea (a small black frog:) Archiaona—in the depths of the Napo forest (lizards chiefly;) Santa Rosa on the Napo (lizards chiefly:) Pebas, Peru, on the Maranon—2200 miles from the Atlantic (snakes chiefly,) and Tabatinga on the Brazilian frontier, (snakes chiefly.)

CROCODILIA.

Crocodilus americanus Linn. *C. acutus* Cuv.

From Guayaquil.

TESTUDINATA.

Testudo elephantopus, Harlan.

From Guayaquil, identical with sp. from the Gallapagos Islands. This species presents the broad posterior vertebral shield of the American T. tabulata and polyphemus.

Chelydra serpentina Linn. Schweigger.

One sp. from Guayaquil, identical with nearctic specimens. This species furnishes a case of distribution unparalleled among reptiles, ranging as it does from the cold regions of Canada to the torrid region of Equador. Peters has already noticed Guayaquil as its most southern habitat, via. Monatsber., Berlin Ac. 1862, p. 627.

SAURIA.

NYCTISAURA.

PHYLLODACTYLUS REISSII Peters, Monatsberichte, Preuss. Ac. Wiss. 1862, 626.
Several specimens of this handsome species from near Guayaquil.

GONIODACTYLUS CAUDISCUTATUS Günther. Proc. Zool. Soc. Lond. 18 , p. .
From near Guayaquil.

GONIODACTYLUS FERRUGINEUS Cope. *Gonatodes ferr.* Cope, Proc. A. N. Sci. Phila. 1863, 102.
From the Napo and Maranon.

A Central American species of this genus is G. fuscus (*Stenodactylus* Hallowell. *Gymnodactylus scapulatus* Duméril. The *G. tenuis* of Hallowell is a Eublepharis Gray, from the Philippine Is.) G. gillii Cope, (l. c. 1863, 102) is G. vittatus Licht. von Martens Nomencl. Mus. Berlin. Was the latter ever properly published?

THECADACTYLUS RAPICAUDA Gray, Houttouyn.
From the Napo and Maranon. Identical with specimens from Yucatan and St. Thomas, W. I.

PLEURODONTA.

IGUANA TUBERCULATA Laur.
One sp. (No. 6645) from Napo or Upper Maranon.

BASILISCUS MITRATUS Duméril. *Ptenosaura seemannii*, Gray.
Near Guayaquil.

HYPSIBATES AGAMOIDES Weigmann.
Napo and Maranon.

LIOCEPHALUS IRIDESCENS Günther, Proc. Zool. Soc. Lond. 1859, icon optima!
Specimens from the Plateau of the Andes, near Quito, No. 6710, and from near Guayaquil.

MICROLOPHUS PERUVIANUS, Girard.
Paita, Peru.

ANOLIS VIRIDIAENEUS Peters, Monatsberichte Preuss. Ac. Wiss. Berlin, 1863, 147,
From Napo or Upper Maranon.

ANOLIS ORTONII Cope, sp. nov.
Of the same group as the last, that is, with smooth abdominal scales, and the median series of caudal scales not larger than the lateral; the tail is, however, only partially preserved, and as it is somewhat compressed the character of the vertebral scales may have been different in the lost portion.

Muzzle convex, wider than long, (measuring at anterior angle orbit,) covered with scales of different sizes. Occiput small, separated by several rows from superciliaries. Scales between the facial rugæ hexagonal, smooth, in four longitudinal rows, a little smaller than the plates of the rugæ which extend to the central row. Dorsal and lateral scales granular, nearly equal, and smaller than the rounded ventrals. Brachial scales a little larger, weakly keeled, antibrachials much larger, keeled. Labials 8—8, the two posterior very small; loreal rows six. Frontal cavity distinct; superciliaries separated by one row scales. Sides of muzzle with longitudinal, smaller, weakly keeled scales. Auricular meatus two-fifths length eye fissure. Infralabials longitudinal smooth, in two or three rows. Supraorbital disc of some seven broad smooth plates, separated from superciliaries by a row of granular scales. Gular fan large.

When the limbs are extended the end of the metacarpal reaches end of muzzle, and the longest toe nearly reaches the orbit. The digital dilatations are well developed.

Top of head, nape, a rather narrow dorsal region and upper surfaces of limbs blackish coppery; sides and below golden, fan deep saffron yellow.

		Lines.
Length from end of muzzle to vent		21·6
" " " "	axilla	9·1
" " " "	ear	5·5
Greatest width head		3·6

From Napo or Upper Maranon.

This handsome lizard differs from A. veridiaeneus Pet in the shorter muzzle with larger plates and fewer large labials, and in the shorter limbs, as well as in coloration. I take pleasure in dedicating this species to Prof. Jas. Orton, of Williams College, to whom Science is indebted for this and other species of much interest included in the present essay.

Diploglossus monotropis Weigmann, Peters. *Camilia jamaicensis* Gray, Catal. Liz. Brit. Mus. 118.

This large scink is not an inhabitant of Jamaica, as given by Dr. Gray, but of Equador, as given by Prof. Peters in Mus. Berlin. I cannot think it right that the species should bear the name erroneously given, and accordingly adopt Weigmann's as above.

One sp. (No. 6694) from Guayaquil.

Centropyx pelviceps Cope, sp. nov.

This species bears much resemblance in structure and coloration to the Monoplocus dorsalis Günther, and would seem to be a mimetic representative in an allied genus. The presence of femoral pores in both sexes separates it generically, and the three additional series of abdominal plates is a marked specific feature.

Dorsal scales small, hexagonal, keeled, graduating into the smaller lateral; abdominals large, keeled and mucronate, in fourteen rows; preanals smooth, of equal size (except a marginal row of small ones) in three oblique series. Spurs large, appressed, two on each side. Caudal scales large, strongly keeled. Large scales on top of foot, tibia below, femur in front and below, fore arm above, humerus above and behind. Collar of a row of large mucronate scales, with three smaller series anterior. Middle gular region with scales little larger than the lateral. Nineteen pores on each femur.

The head slightly compressed, elevated, the superciliary ridges bounding a median concavity and continued back into a strong ridge which follows the margin of the occipital plates and encloses the plates of the parietal region in a deep basin. This margin is cordate behind. In younger specimens this elevation is not prominent, and is entirely absent from specimens of length of (head and body) two inches and less. Rostral shield nearly prolonged back to internasal; the latter broad as long, with straight lateral margins. Frontonasals in extensive contact. Frontal longer than broad, undivided, angulate before and behind. Frontoparietals elongate; interparietal wider than parietals, surrounded by the latter and occipitals, which form a regular disc, emarginate behind and extending nearly to the zygomatic angles. Nuchal scales granular. Nostril on naso-frenal suture. Two frenals, the anterior much the larger, the posterior not extending above the three or more small preoculars. Suboculars two or (divided) three. Superior labials six, inferior five. A symphyseal, a postmental, and on each side three large and two small infralabials, the anterior pair separated by a row of granules. Molar teeth tricuspid, the lateral cusps nearly as long as the median, but much narrower. Premaxillaries eight. Toes long, claws curved; outer toe markedly longer than inner.

Color in spirits bluish green, with a pale dorsal band from the nape to beyond the middle of the back; this is bounded on each side by a heavy black band of the same length, which sends in short branches nearly meeting similar ones from the other. In younger specimens the light dorsal band is brighter and extends from the tip of the muzzle; it is more frequently crossed by black bars. In these short black bars descend on the sides, and cross the upper surface of the tail. Yellowish olive below in all.

	In.	Lin.
Total length of adult	14	6
Length to vent	4	7
" axilla	2	1
" to most posterior part of head shield	1	3
" to anterior margin orbit		7
Width at prefrontal angle		4.5
" at nostrils		2·5
" at angles mandibles		9·5
Length fore limb	1	10·5
" hand		8·75
" hind limb	3	7.1
" tibia	1	1·5
" foot		10·

Specimens of this species (No. 6638) from the Napo or Upper Amazon of Equador.

Ameiva petersii Cope, sp. nov.

Ventral plates in ten series; heel without horny tubercles. Two series of plates on under surface of tibia; frontal plate undivided, four supraorbitals. Inner toe longer than outer, both short. Brachial shields in three rows just continuous with the two series of antebrachials. Two pairs of parietal plates. Gular scales considerably larger on the middle of the posterior border; median scales of posterior fold larger than marginal. Preanal plates scale-like, small, two larger in the centre. Dorsal scales minute, keeled; interparietal plate wider than parietal, frontal narrowed behind; prefrontals well in contact; one large loreal. Postmental plate longer than wide, infralabials five continuous and three pairs posterior oblique. Numerous small plates b·hind the parietals; caudal plates keeled.

Color bright olive, with a narrow yellow band from below orbit to groin, banded above by a broad black band, which is marked by several white dots behind the scapular region, and is bounded above in front by a pale green line to orbit. A narrow dark band from below orbit to groin below the yellow. Sides blackish and pale spotted. The only specimen being young, the coloration of the adult is probably nearly uniform green.

	In.	Lin.		Lin.
Total length	4	10·5	Length fore limb	8 6
Length head and body	1	9	" hind limb	17
" to edge parietal plates		6	" foot	9·5
" " orbit		2·5		

No. , from the Napo or Marañon.

The species is nearest A. l a e t a Cope, but is quite different in the preanal and parietal plates and gular scales It is dedicated to Prof. Wilhelm Peters, of the Friederich Wilhelm's University of Berlin, who has added much to Herpetology.

Teius teguexim Gray. *Tupinambis* Daud.

One sp. (6644) from Napo or Upper Amazon.

Euspondylus strangulatus Cope, sp. nov.

This species is very distinct from others described, in the alternation of the dorsal transverse series of scales, the minuteness of those of the sides, nape and gular region, and in the constriction of the neck.

The general form is slender, the body not depressed, the tail of moderate length and considerably compressed. Neck much compressed, head elevated, flat above, muzzle short, compressed Rostral truncate behind, internasal subquadrate, broad as long, frontonasals longer than broad. Frontal narrower, frontoparietals elongate; interparietal longer than broad, convex behind and projecting beyond parietals. Parietals one pair, in contact with supraorbitals, broader than long. Four well marked supraorbitals, without surrounding granules; five superciliary plates, posterior not smaller. Two loreals, the posterior below the other and continuous with the suborbital plates. The latter small, six, median pair smaller, all separated from orbit by granules. Temporal region with some flat plates, side of head granular, no auricular plates. Meatus auditorius large. Six upper, six lower labials; postgenial large; four large infralabials, two pairs in contact. Gular scales small, larger near rami and collar. Latter distinct, but not free, extending in front of axillæ. Abdominal plates in eight rows, larger than dorsal scales, subquadrate, continuous by two rows with preanals; latter four, posterior pair much larger. Scales of tail smooth below, very weakly keeled above. Dorsal scales separated by a wide lateral granular region, one row of the former resolving itself into two of the latter.

The dorsal scales are in transverse series, which alternate with each other on the median line. They are weakly keeled, longer than broad, and rectangular: they grow smaller on the interscapular region, and disappear shortly in advance of it. Thirty rows between axilla and groin; 10—12 longitudinal.

Digits all well clawed, and with one row of scales below; longest finger ·75 distance to groin when extended; longest toe to the gular fold in like manner. Antebrachium plated above and below, brachium above and behind. Femur plated in front only, tibia below only. Outer toe nearly as long as second, inner short.

Color (in spirits) above olivaceous; sides bluish, with a few very pale dots, hind face of femur similar; under surface head and body light yellow.

	In.	Lin.
Total length	7	
Length to vent	2	5·5
" to collar		10·5
" to end of interparietal plate		6
" to eye fissure		2 5
" of forelimb		10·4
" of hind limb	1	3
" " foot		7·75
Width head at angle mandible		4·5
" " prefrontal bones		2·5
" " nostrils		1·5

I take the present opportuniry of correcting a lapsus calami in a former review of the higher groups of the Reptilia Squamata, where I included the Ecpleopodidæ under the head of families with the temporal fossa with bony roof. This roof is really dermal only, as in the Ameivæ, as already mentioned by Peters.

Mabuia cepedei Gray, Cope, Proc. A. N. Sci. Phila. 1862, 186.

One sp. (6647) from Napo or Upper Marañon.

Ophiognomon trisanale Cope, gen. et sp. nov.

Fam. Chalcididæ. Nostril on the suture between the first labial and supranasal. Head shields above five, viz., two supranasals, one frontal and two occipitals. Limbs minute, four, without digits. Scales smooth, hexagonal, in annuli, those behind vent with a minute pore each. A short longitudinal fold behind axilla. No collar.

This genus is near Chalcis, but differs in the position of the nostril and character of the head shields. The latter above are much like those of some Mexican genera of Calamarian serpents, especially Sympholis Cope—name from Ωφις, serpent, and Γνωμον, a sign.

Char. specif. Muzzle obtuse, slightly projecting, rostral plate visible from above. Supranasals extensively in contact with each other and the first and second upper labials. Frontal large, hexagonal, posterior angle prolonged; parietals larger, obliquely hexagonal, truncate behind. Two superciliaries; four superior labials, posterior largest, truncate behind; temporals three on each side, anterior large. Two very small suborbitals, one minute preocular and a square loreal. Symphyseal narrow, inferior labials three, posterior lanceolate. Geneial rhombic, large; infralabials three on each side, anterior pair extensively in contact, the posterior smaller and separated from temporals by four narrow plates, and from each other by four plates. The median pair of the latter are the larger and join the anterior pair of infralabials. A groove surrounds the throat behind the jaws, which is succeeded by five annuli of equal ovate scales. These are followed by a cross series of six more elongate, which precede a pair of large sternal plates extending between fore limbs. Abdominal scales different from the dorsal, truncate, not hexagonal, in six series. Dorsals in fourteen longitudinal, thirty-seven transverse rows between axilla and groin. Three elongate parallel anal plates; a series of seven small quadrate scales behind vent, each with a pore in the centre. Caudal scales below, angulate like dorsal.

Hind limbs style-like, minute, half as long as anal plates. Fore limbs as long as three anterior labials, consisting of humerus, forearm and carpus, but no digits; three terminal tubercles are probably metacarpal. Tail very long, subquadrate in section; the portion preserved, though nearly as long as the body, presents no diminution of diameter; the general form is probably snake-like, as in Ophiosaurus.

	In.	Lin.
Length head to rictus oris		2·25
" " to gular fold		3·75
" " to axilla		6·5
" " to groin	2	5
" " to vent	2	6·25
Width head at angle mandible		2

Color: below brown; sides with a brown blackish band, which is bounded above by a rather narrow yellow band which commences on the superciliary region. Dorsal region between the latter yellowish gray, bounded exteriorly by a distinct blackish line, and divided medially by an indistinct blackish line. The colors of the tail are similar. Head brownish, paler below.

This species presents several points of resemblance to the Chalcides dorbignyi Dum. Bibr. The specific differences, apart from the generic, may be readily observed on comparing the descriptions. This is no doubt a sluggish animal, and moves much in the manner of a snake. It is the most snake-like of the Chalcididæ, approaching somewhat the Amphisbænia.

One spec., No. 6637, from the Napo or Upper Marañon.

AMPHISBÆNIA.

Amphisbæna fuliginosa Linn. *A. americana* Schreber, Gray.
Napo and Marañon.

OPHIDIA.

SCOLECOPHIDIA.

Typhlops reticulatus Linn.
Napo and Marañon.

ASINEA.

Trachyboa gularis Peters, Monatsberichte Acad. Berlin, 18 , p. *Enygrus*, Jan.

The character of the rostral shield appears to separate this genus from Enygrus, as Peters observes; the cranium is quite similar to that of Ungualia Gray.

From Guayaquil (No. 6683.)

Boa constrictor Linn.

The loreal plate larger than the preocular; two rows scales between orbit and labials. No vertical or loreal brown band.

Guayaquil.

Xiphosoma hortulanum Wagler. *Boa* Linn.
From Napo or Upper Amazon. (6679.)

Ninia atrata Cope. *Coluber atratus* Hallowell, *Streptophorus drozii* Dum. Bibr.
Elevated valley of Quito.

RHABDOSOMA MICRORHYNCHUM Cope, sp. nov.

Seventeen series of scales; supralabials seven, the first very small, the third and fourth entering the orbit. Prenasal larger, very nearly reaching lip. Prefrontals very small, equal postnasal, one-sixth the size of postfrontals. Latter longer than broad. Rostral contracted above by approach of prenasals. Loreal very long. No preocular, on one side two, on the other one postocular. Last upper labial longer than high. First pair of labials united; two pair only in contact with genials. Frontal subtriangular; occipitals elongate. Temporals 1—2. Total length 4 in. 7·5 lin.; tail 8 lin.

Coloration like that of a Tantilla. Above dark brown, beneath pale brown, with a faint line along the margins of the gastrosteges. Top of head blackish, brown behind; a partially complete yellow collar, which widens at the angle of the jaws. A deep brown band from eye to angle of mouth; upper labials yellow brown edged.

Tail slender acute.

No. 6693, from Guayaquil. Nearest the R. badium D. B.

TANTILLA MELANOCEPHALA. *Calamaria* Schl., *Homalocranium* D. B.

Two specimens, the longest measuring 17 inches. In both the postfrontals and labials are in contact, as in our other specimens, and as given in a synopsis of the genus (Proc. Acad. 1861, 74,) and not separated by postnasal and preocular in contact, as given in Jan's Iconographie.

From the valley of Quito.

OPHEOMORPHUS TYPHLUS Cope, Proc. A. N. Sc. 1862. *Coluber* et *Xenodon typhlus* auctorum.

From Maranon or Napo.

OPHEOMORPHUS ALTICOLUS Cope, spec. nov.

Scales in seventeen rows, all rather broad. General form typical, head distinct, plane. Rostral plate flat, very broad, advancing by its whole posterior convex margin on the internasals. Latter broader than long. Frontal with straight, nearly parallel sides, not encroaching on the superciliaries in front; front margin not quite equilateral. Occipitals a little narrowed and divaricate behind. Nasals narrow, postnasal longer than high; loreal very small, quadrate, on one side confluent with postnasal, and not encroaching on the single preocular. The latter is therefore wide; it just appears on the upper plane. One large postocular, the place of a small inferior is occupied by the angle of the large sixth upper labial.

Superior labials eight, seventh higher than long, fourth and fifth and scarcely the third entering orbit. Temporals $\frac{1}{2}$, the anterior only enlarged. Inferior labials ten, six in contact with the genials; the pairs of the latter about equal.

Total length 24 in. 6 lin.; length of tail 5 in. 2 lin.; of gape of mouth 9 lin.

Above green; lower surfaces with lips, and lower part of rostral plate, yellow, separated from nostril to rictus oris from the green by a black band. A black line commences about the length of the tail in advance of the vent, on the suture of the third and fourth rows of scales, and extends to the end of the tail on each side.

From the elevated valley of Quito. No.

Since its establishment by the author, in 1862, this genus has received several additions. The species known are as follows:

O. cobella L. O. breviceps Cope. O. doliatus Neuwied. O. merremii Neuwied. O. alticolus Cope. O. typhlus Linn. O. viridis (*Liophis viridis* Günther, Ann. Mag. N. H. 1862). O. dorsalis Peters, (*Liophis d.*, Monatsberichte Ac. Wiss. Preuss. 1863, 283).

LIOPHIS REGINÆ Linn., Wagler. *Coronella* Schl.

From Napo and Amazon.

LIOPHIS ALMADENSIS. *Natrix almada* Wagl. *Liophis wagleri* Jan.

The adult; the specimen figured by Wagler and Spix appears to be young. Napo and Maranon.

LIOPHIS PYGMÆUS Cope, sp. nov.

This species is much the smallest of its genus; in size and appearance it is like a burrowing snake of the Calamarinæ, but its dentition, squamation, pores, and even style of coloration, are those of this genus. It is undoubtedly adult or nearly so.

Head slightly distinct, ovate, narrowed in front, muzzle slightly prominent. Rostral plate much broader than long, just visible from above. Internasals broader than long. Frontal large, elongate, longer than muzzle in advance of it, sides straight; superciliaries rather narrow. Occipitals elongate, including a notch behind, each bounded by two large temporals and 1½ small scales. Postnasal lower than prenasal, loreal still lower, subquadrate encroaching on the preocular. Latter scarcely visible from above. Postoculars two, inferior half superior, both in contact with temporal. Upper temporal bounded by three scales, anterior larger, joining last labial. Superior labials seven, third and fourth entering orbit, sixth largest. Inferior labials eight, five in contact with genials. Latter, pairs equal.

Scales in seventeen rows, uniporous, those of the first larger.

Total length 7 in. 2 l.; tail 1 in. 1·5 lin.; that is 6·3 in the whole. Thus this portion is shorter than in the genus generally; it is quite stout. Gastrosteges 12·8, anal 1 | 1, urosteges 31.

Above deep olive, leaden on the sides and the ends of the scuta. Below uniform yellow. A black line from orbit to anterior lower angle of last labial. A broad black collar which encroaches on the occipitals, which is directed backwards and does not reach the gastrosteges. Continuous with the extremity of this, on the second, third and fourth rows of scales is a series of small black spots separated by intervals of from three to two rows; near the middle of the length these join and form a black band, which extends to the end of the tail. The median dorsal region becomes darker, and on the posterior fourth forms an indistinct band. Where the epidermis is lost and the skin is stretched the scales are white-edged. Top of head darker brown than sides. Lips not margined.

One specimen, 6,668, from Napo or neighboring pt. of Maranon.

DROMICUS LATERISTRIGA? *Liophis lateristriga* Berthold, Jan's Iconographie des Ophidiens.

The individuals in the collection differ from Jan's figure in a less distinct lateral stripe, and presence of occipital cross-band. It is not probably distinct. A description is, however, added:

Body cylindric, head flat, muzzle short. Scales in seventeen rows. Superior labials eight, fourth and fifth margining orbit, second to sixth inclusive, higher than long. Loreal higher than long; nasals nearly equal; one large, one small inferior preocular; the superior sometimes divided. Postoculars two, both in contact with the only elongate temporal. The latter is followed by two rhombic temporals, the first one above the seventh and eighth labials; and two scales on margin of occipital. Occipitals narrowed behind, as long as width between outer margins of superciliaries behind. Frontal, anterior and superciliary borders equal; prefrontals broader than long, rostral scarcely visible from above, much broader than high. Length of muzzle from opposite anterior margin eye, equal width frontal and one superciliary shield in front. Inferior labials eight, fifth largest, seventh next. Posterior genials equal anterior. Gastrosteges 155; anal 1 | 1; urosteges 69+; tail probably one-third or more lost.

Color above, a rich dark brown, the sides of the head darker; an irregular yellow band passes across the middle of the superior labials and passes round the nape on the fifth row scales behind the occipital plates and joins its fellow. A yellowish band passes along the outer margins of the two pairs of frontals, the superciliaries and the anterior third of the occipitals, interrupted at each suture. The dark of the upper surface extends on the gastrosteges, and is traversed for a considerable part of the length, and by a faint line forward, by a streak on the middle of each scale. A similar line, equally indistinct, traverses the scales of the fifth row, becoming more apparent on the tail. Color of lower surfaces deep orange red; lower labials and chin blackish.

Length of head and body 16 in. 9 lin.

This species is nearest the D. brevirostris Peters,* and D. temporalis† Cope. The two preorbitals, single large temporal, coloration and other points distinguish it. Its form is that of Pliocercus Cope, but belongs to Dromicus on account of its diacranterian dentition.

Two specimens (6702) from the elevated valley of Quito.

TACHYMENIS CANILATUS Cope, sp. nov.

This species differs from the known species in a more slender form; and in general appearance approaches the Lygophis elegans of Tschudi.

Scales in nineteen rows, elongate, thin, with single terminal pores. Superior labials eight, fourth and fifth bounding orbit, sixth larger than seventh. Inferior labials ten, fifth and sixth long and narrow. Posterior geneials longest. Nasals large, distinct; loreal long as high, lower in front; preocular single, just reaching vertical; postoculars two. Temporals 1—1—2, the middle one largest. Parietals narrowed behind, whole plate one-fifth longer than frontal, common suture one-fifth shorter than same. Frontal narrower than each superciliary, spreading a little in front. Muzzle flat, internasals longer than broad, canthus rostralis strong. Rostral small, flat Gastrosteges 199, anal 1—1, urosteges 98. Total length 18 in. 4 l.; of tail 5 in. 4; of gape 5 lin.

Color leaden gray on the sides, bounded above on the sides by a faint blackish streak; dorsal region brownish grey, with a double row of brown spots, when confluent covering five rows of scales. On the posterior half the body and tail they unite into a vertebral band, which is separated from the gray of the sides by a pale brown band. A dark band through frontal plate, split by a pale one; a pair of white dots on the parietals, as in Tropidonotus sp. Lips and belly below light yellow, the former brown-specked medially, black margined above posteriorly. A brown band outside of muzzle. Each gastrostege with a row of brown dots its whole length.

This species was not obtained by the Orton expedition, but was sent from Guayaquil to the Smithsonian Institution in a collection made by Messrs. Destruger and Reeve.

CONIOPHANES DROMICIFORMIS Cope, Proc. Acad. 1866, 128. *Tachymenis dromiciformis* Peters, Monatsberichte Preuss. Ac. 1863, 273.

In four specimens of this species I find no scale-pores, and but one preocular. Prof. Peters describes scale-pores as present in his types, but I failed to see them on examination of the same specimens, which he permitted me to make. This character alone distinguishes this genus from Tachymenis, though I ascribed the same importance, on a former occasion, to a supposed difference in the number of preocular plates. That this is of little value in this case, I can now agree with Peters in believing.

From Guayaquil. No. 6689.

RHADINÆA CHRYSOSTOMA Cope, sp. nov.

This species agrees with those of Rhadinæa in technical characters only. Its proportions are those of Opheomorphus, from which it differs in the entirely equal teeth. It might be referred to Hypsirhynchus, but in that genus there is a single scale-pore, in the present they are wanting. The vertebræ are not furnished with hypapophyses on the posterior third of the length, but are keeled below.

Head elongate oval, quite distinct; muzzle truncate when viewed from above or in profile, not projecting. Rostral plate scarcely visible from above; prenasal higher than postnasal; loreal high as long, encroaching very little on preocular, which latter does not reach frontal. Oculars 1—2, temporals 1—2.

* Monatsberichte Preuss. Academie Wiss. 1863, 280.
† Proc. A. N. Sci. 1860, 307.

Anterior touching both postoculars. Labials 8—10; the upper with fourth and fifth entering orbit, chiefly the fourth, which is longer than fifth. All longer than high, the seventh largest, longer above than on labial border. Genials long, anterior longer than posterior. Frontal elongate with nearly parallel and slightly concave sides; occipitals moderate, narrowed behind. Scales in seventeen rows, all of nearly equal size and rather broad.

Total length 8 in. 4 lin.; of tail 1 in. 6 l.; of gape 5·35 lines. The tail is thus as short as in Opheomorphus. Eyes rather small. Internasals about as wide as long. Gastrosteges 157; anals 1 | 1; urosteges 57.

Upper surface of head and body dark-brown, which is bordered, except just behind the head, by a series of small round brown spots on each side, which become a band on the posterior fourth. Below this and ground of belly yellow, which is prolonged as a band along upper labials to rostral, leaving a black labial margin. Belly with black cross-bars and halves, more sparse posteriorly, confluent anteriorly on the fourth of the length; this is here and there spotted with yellow.

From the Napo or Maranon. No. 6665. This single specimen is probably not fully grown.

Masticophis pulchriceps Cope. sp. nov.

This species is described from a specimen twenty-one inches long, and not probably adult. The coloration of the dorsal region has considerable resemblance to that of the young of M. r a p p i i Gthr.

Rather slender, the head quite distinct, rather short, somewhat flattened and with broad muzzle. Tail 3·6 times in the total length. Superior labials eight, the anterior short, the two posterior elongate, the third, fourth and fifth in contact with the eye, the fifth and sixth elevated. Orbitals one—two; the loreal higher than long; temporals 2 | 2 on each side, the upper anterior the smallest. Internasals broader than long, rostral prominent, scarcely visible from above. Frontal little concave laterally, least width little less than ·5 length and equal greatest width the superciliaries. Greatest length occipitals exceeds same of frontal; they are truncate behind, and with straight outer margins. Inferior labials ten; pregenials much shorter than postgenials.

Scales of body smooth, in seventeen rows, second as large as the others. Gastrosteges 170, anal 1 | 1, urosteges 100.

Ground color above and below dark-blue gray, which is largely obscured in the following manner A series of quadrate black spots extends from nape to near end of tail, alternating with a lateral series of the same, without line of demarkation between. Each spot is separated from the next by a cross-bar of ground color, in which all the scales are white-edged. These bars are prolonged on the gastrosteges, and their extremities fall into a line of yellow spots on a blackish band, which extend on each side to vent. The cross-bars are only one scale wide. A black nuchal cresent, which extends as a band on each side through orbit round end of muzzle. This sends a bar to the edge of the lip at the orbit and angle of mouth, which connect on the lip. Gular region black with numerous yellow spots. Top of head dark brown, with numerous paler brown marks within the margin of each scale.

One sp. (6704) from the plateau valley of Quito.

Masticophis brunneus. *Herpetodryas brunneus* Günther, Catal. 116. *Drymobius* Cope, Pr. A. N. Sci. 1860.

Two sp. (6705), one from Guayaquil and one from valley plateau of Quito. Both belong to a variety with an indistinct series of small dark spots on each side of the vertebral line, forming an incomplete longitudinal streak.

Herpetodryas carinatus Boie, Linn.

Valley of Quito; Guayaquil; Napo and Maranon, 6706, 6682, 6661, the last all of the var. fuscus.

Spilotes piceus Cope, sp. nov.

This species exhibits the isodont dentition and entire anal plate of Spilotes, with the cylindric body and elongate tail of Bascanium. The relative length of tail, within the proportions included by the genera in question, is, however, a more variable character than the integrity of the anal plate as a generic feature in our estimation. I therefore refer it to the Spilotes series. The divided anal plate is also characteristic of Masticophis, (Peters describes a Mexican species in which he says it is variable) ; this species is, however, more massive than these, and generally proportioned as the Bascanium constrictor.

Scales in fifteen rows, broad, subequal, all smooth. Tail 3·6 times into the total length. Head rather distinct, ovate, muzzle not prolonged. Anterior margin four-fifths total length ; lateral margins slightly concave. Prefrontals broader than long. Occipitals concavely, continuously truncate behind ; temporals 2 | 2, entirely in contact with two last labials. Only one small plate besides bounding occipital. Superior labials eight, fourth and fifth bounding orbit ; sixth subtriangular, in contact with lower postocular. Postnasal higher than prenasal, loreal higher than long, one pre- two short postoculars. Inferior labials nine ; postgenials considerably longer than the pregenials. The rostral plate is rather narrowed and with concave sides ; it is barely visible from above.

Above and gastrosteges to one-fourth their length on each side, deep black. Lower surfaces, with upper labial shields, yellow ; black margin dividing two last labials horizontally ; no dark margins to labials.

Total length 51 in. 8 lin. ; of tail 13 in. 8 l. Gastrosteges 169 ; anal 1 ; urosteges 92.

This fine species is from the Napo or Upper Maranon. No. 6660.

To this genus must be referred the *Geoptyas collaris* and *G. flaviventris* Steindachner (Sitzungsber. Wien, 1867, 271), while the name *Geoptyas* applied to Coryphodon pantherinus and C. constrictor of the Erp. Générale must become a synonym of Bascanium, Baird and Girard. *G. collaris* is Sp. melanurus, from Mexico, while the *G. flaviventris* is too near Sp. corais.

THRASOPS CUPREUS Cope, sp. nov.

A slender, cylindric species, with an unusually short broad head.

Scales in fifteen longitudinal rows, the three median a little larger than the others and equal, the median five, keeled, the keels invisible or nearly so, when the epidermis is lost. Head flat above, muzzle contracted and short. Rostral plate little visible from above, much broader than high, internasals subtriangular, behind broad as long. Prefrontal on one side descending to labials, on the other, all below the canthus rostralis cut off as a large loreal. Frontal not longer than supercilaries, with concave sides and a right angle behind. Occipitals well developed, broad, broadly truncate behind, bounded by five temporals. The anterior of these is much the largest and in contact with three labials and the postoculars ; behind it a second large plate borders the last labial only. Superior labials eight, none elevated, fourth and fifth margining orbit ; oculars one, two, the inferior posterior minute. The long narrow nasal is acuminate posteriorly, and borders the first and half the second labial, and the internasal plate exactly.

The number (15) of rows of scales is retained on the neck. Total length 20·5 in. ; of tail 8 in. ; of gape of mouth, 5·5 lines. Gastrosteges 152, anal divided (generic char.) ; urosteges 136.

Color above metalic copper color, with the shades at the bases of the scales, and cross-shades of the same on the anterior half of the body. A narrow dark streak from nasal plate along upper edges of labials ; the latter and chin yellowish white, below brown copper colored, with darker dashes. When the epidermis is lost, which very readily occurs, the derm appears of a coppery silver color.

From the Napo and Maranon. No. 6666.

THRASOPS OCCIDENTALIS, *Ahætulla occidentalis* Günther, Proc. Zool. Soc. Lond. 1859, 412.
From Guayaquil, from Messrs. Detruger and Reeve.

OXYBELIS ACUMINATUS, Wied.
Guayaquil, 6687.

OLISTHENES CORONATUS, *Scytale coronatum*, Dum. Bibr. Gthr.

OXYRHOPUS SEBÆ, Dum. Bibr. vii, 1056.
From the valley of Quito. The stomach contained a Liocephalus.

LEPTOGNATHUS BUCEPHALUS Cope, *Dipsas* Schleg. *Dipsadomorus indicus* Dum. Bibr. *Dipsadomorus bucephalus* Jan. *Leptognathus indicus* Günther. Tab. Seba, xliii, 4-5.

This species is no doubt the type of Laurenti's genus Dipsas, as I have pointed out, (Proc. Acad. 1860) but by the rule of exclusion, as Leptognathus was first taken from it, the remaining species, to which Duméril and Bibron applied the name Triglyphodon, should retain the original name.

Fine specimen; Napo or Maranon.

As the species in the Academy are not embraced in the Erpetologie Générale and other works, I give a synopsis of those known to me, six of them not described in any general work. The species not embraced in the Equador collections are described at the end of the catalogue. I have been aided in this by Jan's Elenco serpentium.

Group I. Dorsal scales smooth, a larger vertebral series; anterior genials very short; two pairs of inferior labials in contact in advance of the genials. (*Dipsadomorus* D. B. Jan.)

Scales in 13 rows; a large preocular; above and below liver brown, with broad lighter cross bars, which terminate in a bright yellow spot on the edges of the gastrosteges; six genials, with lateral plates behind .... BUCEPHALA.

Scales in fifteen rows; no preocular; four genials; dark brown, with darker cross-bars; below yellow with lateral dark spots... VARIEGATA.

Group II. Scales smooth, vertebral series larger; anterior genials small, preceded by one pair of labials;

α. Loreal plate not reaching the orbit.

Two preoculars, two postoculars, scales in thirteen rows; vertebral plates reaching occipital; nine upper labials; chestnut brown, with black yellow-edged discs on the sides which become confluent into broad cross rings anteriorly, separated by yellow; head black with yellow collar and cross band on muzzle............................. CATESBYI.

αα. Loreal plate entering the orbit.

β. Two postoculars.

Thirteen series of scales, (ten) eleven superior labials, one preocular, twelve inferiors, six genials, without laterals, vertebrals not reaching occipitals; light, a series of broad rounded, brown light edged dorsal spots, just reaching gastrosteges; belly unspotted .... PAVONINA.

Fifteen series scales, nine superior labials, no preoculars, eleven inferiors, four genials, no lateral genials, vertebrals not reaching occipitals; much compressed; yellow with broad brown entire annuli; nape and temples and spots on muzzle yellow........ .... ARTICULATA.

Fifteen series scales, seven superior, nine inferior labials; two, one, or no preocular; six genials, with laterals, vertebrals broader, body shorter; brown, with continuous or alternate narrow, dark brown yellow-edged cross bars; belly with few lateral spots, top of head with five dark light-edged ocelli.. .... MIKANII.

Fifteen series scales, vertebral little larger; seven superior, eleven inferior labials; six genials, no laterals; less compressed; yellow, black specked, with broad black equal annuli, not quite complete, on the belly, and dorsal black spot between; head black, varied above, belly much black spotted......... .... OREAS.

ββ. Three or four postoculars.

Vertebral series larger, no preoculars; ten superior and inferior labials, six genials with laterals; fifteen rows scales; light brown with a series of blackish cross bands, very broad anteriorly, much narrower and more numerous on most of the length; a series of brown spots below.................................. .... INÆQUIFASCIATA.

Group III. Scales smooth, vertebral series larger; anterior genials forming a long pair as in other serpents, preceded by one pair labials. (*Petalognathus* D. B.

Fifteen rows scales, dorsal series not reaching occipitals; no preoculars, two postoculars; four genials, no laterals; thickly brown dusted, with brown yellow edged dorsal cross bars which are or are not continuous with a lateral series which is continued on a portion of the gastrosteges; below yellow..... .... NEBULATA.

Group IV. Scales smooth, dorsal series not larger; anterior genials elongate, colubriform, preceded by one pair of labials.

Thirteen rows of scales, no pre-, two postoculars; seven superior, eight inferior labials; three pairs genials, without laterals; black with yellow rings continuous on the belly but not on the anterior parts above; yellow scales black edged; temple and nape yellow............... ANTHRACOPS.

Group V. Scales equal, smooth; genials short, broad, preceded by two pairs of labials.

Fifteen rows scales, one preocular and a subloreal, three postoculars, nine superior, eleven inferior labials; slender, compressed; black with narrow yellow annuli; chin all black, a yellow collar .... BREVIFACIES.

Group VI. Scales equal, smooth; genials short, broad, preceded by one pair inferior labials.

Form little compressed, scales in fifteen rows; eleven superior, eight inferior labials; no preoculars, two postoculars; four genials without laterals; yellow brown, with three rows black, yellow edged subquadrate spots, which unite in front and become also longer; head spotted, small spots on sides of belly....... TURGIDA.

Group VII. Scales equal, several dorsal series keeled; first pair of genial plates short, preceded by one pair of labials only. (*Tropidodipsas* Gthr.)

Head more elongate, scales in seventeen rows; two anterior, two posterior oculars; three pairs genials, seven upper labials ; black with nearly equal yellow annuli ; not complete on belly.. FASCIATA.

Head short, broad ; scales in seventeen rows, the three median only keeled ; one preocular, loreal reaching orbit, two postoculars, three pairs genials ; six superior, nine inferior labials ; black with narrow yellow rings, yellow scales, black tipped................... .... SARTORII.

The seven groups of this genus do not represent genera, but rather sections, for the following reasons. The vertebral series of dorsal scales is so reduced in L. o r e a s Cope, as to constitute it a link between the two types in this respect. The keels are so weak in L. s a r t o r i i Cope, and the allied L. a n t h r a c o p s Cope being smooth, this character appears to have no more than specific value. The elongate pregenials, appear to constitute a strong distinction, but in one of our numerous L. n e b u l a t a they are divided as in other species. Lastly, the peculiarity of the junction of two inferior labials is less to be relied on, in view of the fact that in one of our L. b u c e p h a l a there is one on one side and two on the other in front of the genials.

LEPTOGNATHUS CATESBYI Günther, *Coluber* Weigel, *Stremmatognathus* D. B.
Apparently abundant on the Napo and Upper Maranon.

LEPTOGNATHUS OREAS Cope, sp. nov.
Body less compressed posteriorly than anteriorly. Frontal plate broader than long, very obtuse behind. Occipitals 1·75 times longer, narrowed and divergent behind. Temporals one large anterior higher than long, in contact with both postoculars ; two broad ones, lower joining last labial, then a row of four. Four anterior labials not narrowed, third, fourth and fifth entering the orbit ; the three last longer than high.

Dorsal band wider anteriorly, approaching on the sides ; behind they are not all continuous, but alternate on the sides, then also the light intervals are much obscured, no black collar. Chin and throat yellow. An irregular black yellow edged band on each side of head from behind occiptals to middle of superciliaries ; other head plates with similar black margins. Upper labials yellowish, with a black line from loreal plate, one from orbit, and a broad one over last labial, including two last lower labials. Belly largely obscured with black.

Gastrosteges 180, anal 1 ; urosteges 90.

Total length 26 in. ; of tail 7 in. ; of gape of mouth 8 lines.

From the elevated valley of Quito. (No. 6707.)

LEPTOGNATHUS NEBULATA Günther, Jan. *Coluber* Linn. *Dipsas* Schleg. *Petalognathus* Dum. Bibr.
No. 6708 from the valley of Quito.

This species is the most extensively distributed of the genus. It ranges from the Tierra Caliente of Vera Cruz (Sumichrast) to Nicaragua (Caldwell) to Caraccas (Ashmead) and Dutch Guiana (Hering) ; according to Günther from Pernambuco.

HIMANTODES CENCHOA L., D. and B.
Napo and Maranon. No. 6670.

LEPTODIRA ANNULATA Linn., Fitz.
Napo and Maranon, and Guayaquil.

PROTEROGLYPHA.

PELAMIS BICOLOR.
From Guayaquil and Panama, apparently not rare.

ELAPS LEMNISCATUS Linn.
Guayaquil, (6685.)

ELAPS MIPARTITUS Dum. Bibr.
Four specimens from Guayaquil, and one from the valley of Quito.

ELAPS IMPERATOR Cope, sp. nov.
This is a species of the E. corallinus group, and is nearest to the series B. II. *a. γ. aa.* of Günther's synopsis of individuals of this genus;* or to the E. ornatissimus of Jan. It differs from the latter and from all others, in that the black bands are wider than the red and cease at the third row of scales, not extending on the first two, or on the gastroteges. The two rows are margined with black on a yellow ground. Black bands 7·5, red ones 5 scales wide; scales in the latter, of the first row, narrowly, of the two following broadly tipped with black; the remaining dorsal series entirely black or with a faint basal shade of red. Yellow margins on half scales alternating. The red bands cross the belly on two and a half gastrosteges. Top of head and nape black, except outer half of internasal and prefrontal plates, which with the labials are yellow. Labials black edged, not in contact with temporals, which are yellow edged at bases. Lower lip, rostral plate, chin and belly unspotted, yellow. Two postoculars, Gastrosteges 225, anal 1 | 1: urosteges 37.
Total length 2 ft. 3 in. 4 lin.; of tail 2 in. 7 l.
From the Napo and Maranon; one specimen.
It is difficult to imagine a more elegantly colored species of this beautiful, but venomous genus. Dr. Günther has shown the inconstancy of colors in some species of the genus. Within certain limits the species are very constant, as I have had occasion to observe in numerous specimens of E. lemniscatus, E. elegans, E, mipartitus, E. nigrocinctus, E. euryxanthus, E. fulvius, etc.

SOLENOGLYPHA.

TELEURASPIS NITIDA Cope. *Lachesis nitida* Günther, Proc. Zool. Lond., 1859.
From Guayaquil.

TRIGONOCEPHALUS BRASILIENSIS. *Bothrops jararaca* Wagl. *Craspedocephalus* Gray.
Three specimens from Napo and Upper Amazon; the smallest with fifteen urosteges behind the vent, undivided.

TRIGONOCEPHALUS XANTHOGRAMMUS Cope, sp. nov.
Form rather elongate; head elongate, muzzle short. Scales of body in twenty-seven longitudinal series, not strongly keeled, the dorsal narrow, those of the first row ovate, longer than broad. Scales of the whole top of the head small, smooth, nine or ten rows between the large superciliary shields. Four elongate plates in a row on top of the end of the muzzle, which are bounded behind by four much smaller ovate ones. Superior labials seven, the second bounding the pit anteriorly; the last five large and of nearly equal size, inferior labials eleven, the two anterior broadly in contact in front of geneials. Two preoculars are loral, two nasals; rostral elevated. Gastrosteges 196, urosteges 54.
Color above very dark olive, with a zigzag yellow line on each side from the head to the origin of the tail, the apices of the open Vs usually meeting on the vertebral line, enclosing dorsal rhombic spaces and lateral triangles. The bases of the triangles embrace seven or eight transverse series of scales. Gastroteges black, paler medially, with yellow irregular spots at their extremities. Gular region, chin, and superior labials bright yellow; a bright golden band round the end of the muzzle, involving the greater part of the superciliary plates, passes to the nape, and is bounded below by a black band from eye to angle of mouth; top of head black, with a pair of undulating yellow bands from the nape which meet on the vertex forming a V.

* Ann. Magaz. N. Hist., 1859, 171.

	Inches.
Total length	60·7
Length of rictus oris	1·75
Length of tail	7·5
Width between outer margins superciliary plates	0·7

From Pallatanga, Equador. Two specimens.

BATRACHIA.

ANURA.

ARCIFERA.

CINCLIDIUM GRANULATUM Cope, Journ. Acad. Nat. Sci., 1867, 202.

Length body and hind limb together 8·5 inches. One specimen. No. 6659. From the Napo or Upper Amazon.

HYLA MARMORATA Daudin, Dum. Bibr.

This species is quite distinct from that described and figured under this name by Burmeister.* The latter being without name may be called H. s e n i c u l a .

I append a description of the fresh coloration of this species, which does not appear to have been recorded.

Ground color above gray, with two large blackish blotches which extend backwards on the sides, one from the iliac, and one at the axillar regions. These are confluent on the middle line of the back, leaving only the scapular regions and insignificant spots of the ground, which is more or less replaced by bay. The last color forms a V-shaped figure with broad black border, whose limbs reach the orbits and enclose a pink gray space which is bounded in front by a black interorbital cross-band. Top of muzzle light bay. Gular region pale, with dark gray speckles. Belly and femora, except a narrow band above, with basal part of humerus, yellow black spotted; the spots smaller and thicker on the belly. Upper surfaces of limbs dark gray with rufous shades, cross-barred with darker. End of humerus and femur, fore arm and band with tibia and whole foot black below; the distal halves of the webs yellow. Dermal margin of ulna and tibia white.

From the Rio Napo or Upper Amazon below its mouth. Eleven specimens. This species is strikingly different from others of this genus, in the great extent of its webs, and the singular coloration. It appears to be abundant in the region named. No. 6649.

HYLA LEUCOPHYLLATA Beireis. *H. frontalis* Daud.

A variety in which the brown dorsal patch does not bifurcate to the lateral band, and the muzzle is rather more elongate.

Napo and Upper Maranon. No. 6650.

HYLELLA CARNEA Cope, sp. nov.

This is a small species with a broad rounded head, and slender body and limbs. The canthus rostralis is moderately distinct, and the tympanum indistinct and small, and surmounted by a fold. Eyes large and prominent, diameter ·25 greater than length of muzzle in advance of them. Nostrils terminal, end of muzzle vertical. Tongue round, ·25 free behind. Ostia pharyngea equal inner nares. Fingers ·33 webbed, and with dermal margins; dilatations of moderate size. Skin of body above smooth.

The exterior coloration does not appear on the femur, which is unicolor behind, and only as a faint line on humerus. This pigment is light rose yellow; three narrow bands across tibia, two across fore arm. A broad blood-red band between the eyes, each extremity sending a blood-red band on each side the back to the vent, with a connecting spot of the same on the coccyx. A deep

* In Erlaüt. z. Naturg. Braziliens.

red band from scapular region to end of muzzle; and line below the eye. Below uniform whitish.

	Lin.		Lin.
Length head and body........	9	Width head.	3
" hind limb...........	14	Length gape.	2
" hind foot.........	6		

From the Napo or Upper Maranon, (6728.)

The third species of this little known genus.

PITHECOPUS TOMOPTERNUS Cope, sp. nov.

This genus with Agalychnis Cope, and Phyllomedusa, embrace the most brilliantly colored of tropical Batrachians. Their characters were first pointed out by the writer in Journal Ac. Nat. Sci. Phila. 1866. The species of Pithecopus Cope, are now four, two having been added by the William's College Expedition; they may be distinguished as follows:

I. Parotoid stratum of crypts not visible externally; no external surface pigment on humerus.

a. A yellow band round upper lip to middle of sides; pigment of fore arm extending on two outer fingers; dilatations small; second toe shorter than inner.

No dermal processes on heel; lower eyelid transparent; no vomerine teeth; concealed portions of limbs and sides with vertical brown bands; small ....P. AZUREUS Cope.

No dermal processes on heel; lower eyelid reticulate; vomerine teeth; concealed surfaces of limbs with vertical brown bands; fewer of the same on sides, and brown spots behind axilla; small...P. HYPOCHODNRIALIS Daudin.

aa. No yellow band on upper or lower lip or side; external pigment not extending on outer fingers; dilatations large, second toe longer than inner.

Lower eyelid reticulate; vomerine teeth; two angular dermal heel processes, together having a truncate posterior outline; concealed surfaces brilliant yellow, with broad vertical purple bars; size larger—
P. TOMOPTERNUS Cope.

II. Parotoid stratum of crypts distinct, extending from orbit to sacrum; humerus covered with the external pigment.

a. No yellow band on upper lip, an imperfect one on side; outer fingers and toes covered with the external pigment; dilatations large, second toe shorter than inner.

No dermal processes; lower eyelid not reticulate; vomerine teeth present; green, upper arm with a yellow band; concealed surfaces of limbs with purple clouds; below purplish; large......... ....P. TARSIUS Cope.

P. tomopternus has much the coloration of Agalychnis sp., and the whole form a series leading from Hyla to Phyllomedusa.* The P. tarsius ap-

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* One species of this genus has been long known, but has been confounded by modern authors with the longest known species of the genus Pithecopus. A second species is here added.

Inner toes equal; dilatations large; sides little, limbs unspotted; skin with stellate bony deposits.. scleroderma.
Second toe shorter than first; dilatations small; sides, throat and limbs largely yellow-spotted; skin smooth............................... bicolor.

P. SCLERODERMA sp. nov.

One of the largest of the Hylidæ, measuring from end of muzzle to vent 4 in. 1·5 lines, same to posterior border tympanum 1 in. 3·4 l.; between parotoids and scapula. 1 in. 6·5 l. Axilla to carpus 1 in. 11·6 l. Carpus to end of third finger 1 in. 2·5 l. Femur and tibia 3 in. 0·6 l.; tarsus 1 in. 3 l.; tarsus to end fourth toe 1 in. 4·6 l.

The general form is much that of P. bicolor, but the toes are longer and provided with larger dilatations; the under face of the tarsus, and the skin generally, are devoid of dermal tubercles. The integument of the whole upper surface of the head and body is studded with aggregations of osseous radii, which surround, more or less, numerous proaches the last named genus most closely, and equals them in size. Of the P. azureus I have seen three specimens from Brazil, two from the upper Paraguay, and one from Pernambuco; of the P. hypochondrialis one specimen from Dutch Guiana.

The P. tomopternus is of elongate form; width of head 3·3 times from end of muzzle to end coccyx. Loreal region elevated, plane, canthus rostralis contracted, muzzle not quite vertical in profile. Tympanum one-third the large eye. Vomerine in two small fascicles opposite the anterior part of inner nares, as far apart as each is from the choana. Inner nares very large, rather larger than ostia of eustachian tube. The elbow reaches end of muzzle, the heel to front of orbit. A dermal fold on lower arm, strong on elbow; a weak one on tarsus, terminating above in two heel processes, one projecting inwards and one outwards. All the fingers and toes entirely free, thumb opposable, fourth finger considerably longer than second. Longest toe the fourth, then 5, 3, 2, 1. Palm and sole with strong tubercles.

The colors are very brilliant; above green, below with hands and feet yellow; outer fingers and toes bound with purple, like the concealed surfaces. One specimen has an exceedingly narrow yellow margin to the upper lip. No brown margin inside lower lip.

	Lines.
Total length head and body	23·
Length to posterior margin tympanum (axial)	6·1
" fore limb	15·6
" hand	5·6
" hind limb from groin	32·6
" tarsus	7·75
" metatarsus and longest toe	7·

Two specimens of this tree-frog are in the collection from the Rio Napo, or Upper Amazon, below the mouth of the former. They are males and have the corneous thumb shield of the breeding season. No. 6651, Mus. Smiths.

PITHECOPUS TARSIUS Cope, sp nov.

Form slender; width of head at jaws, enters from end nose to vent, 3·5 times. Loreal region elevated, with the canthus concave; upper lip projecting beyond muzzle. Diameter of eye three times tympanum. Tongue elongate, largely free and openly marginate behind, narrowed in front. Vomerine teeth in two transverse fasciculi, which are equi-distant trom each other and the anterior margin of the large internal nares. Ostia large and less than nares. Skin everywhere granular, perhaps more properly glandular, those of the sides largest. Areolæ very large and flat on the pectoral region; a series of larger glandulous areolæ on each thigh below. No distinct dermal margin on forearm or tarsus. Digital dilatations of hand largest, larger than the tympanic disc; that of the thumb smaller. Elbow to opposite nares; heel to front of orbit. Second toe much shorter than first, third less than fifth.

Color everywhere green, shaded with purple on gular and thoracic regions; also along sides and on under surfaces of thumbs. Femur green, except below, two external digits of the same color. An irregular yellow band on side from

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central points. These do not penetrate through the derm, which is thick, and entirely free from the skeleton in every part. Muzzle elevated, loreal region straight, canthus rostralis strong, concave. Male with vocal vesicle. Tympanum one-half of orbit; inferior palpebra medially transparent, dermoid at the circumference. Vomerine fasciculi oblique between nares as near the latter as each other. Minute areolations on posterior gular region. Tongue small. Elbow extends to end of muzzle; hand and longest finger equal forearm. Heel to orbit; sole and longest toe exceeding tarsus; cuneiform tubercle minute; base of thumb broad, with a flattened tubercle.

Blue-green with faint light margin to posterior parts of upper and lower lips, and one series of very narrow longitudinal lateral spots. Limbs blue above, except the pale brown spotted upper arm; antebrachium and tarsus yellow margined; femora uniform pale blue behind. Below uniform pale.

Habitat.—Surinam, *Hering*, Mus. Academy Nat. Sciences. Burmeister suspects the species of the Amazon to be that found in Surinam, and different from the P. bicolor.

angle of mouth and margin of mandible. Two isolated yellow spots on breast, and one on each side the vent below.

		In.	Lin.
Length	head and body	3	9·25
"	head, axially, to line tympanum	1	
"	fore limb	2	8·
"	hand	1	
"	hind limb from groin	5	3·
"	tarsus	1	4·15
"	remainder of foot	1	2·25

This tree-frog, it is to be observed, exceeds the Phyllomedusa bicolor in size. One male with the file-like corneous plates on the metatarsus of the thumb is in the collection, from the same locality as the last. No. 6652, Mus. Smithsonian.

HEMIPHRACTUS DIVARICATUS Cope, sp. nov.

A single specimen of this species has afforded the first opportunity of investigating the structure of this genus. The result convinces me of the propriety of recognizing in it a peculiar family as Peters has done, and confirming entirely the position I assigned it in the essay on genera of Arcifera.* The form of the distal phalanges is a compromise between that of many aquatic frogs and that of the Hylidæ, the proximal globe being not recognizable, and much flattened. Its structure is different from that of Hylodes, though it does not probably inhabit trees any more than that genus, or Chorophilus and Acris among true Hylidæ.

The coracoid and epicoracoid are much less divergent than in other families, and the arched cartilages are very wide, overlapping more extensively than in any genus I am acquainted with.

The H. divaricatus is nearer the H. scutatus than to the H. fasciatus. It differs from the latter chiefly in the form and proportions of the helmet; this is shorter and broader, with more divergent outlines, and is plane and flat behind, and not so convex; it lacks the recurved margin represented by Peters. In profile the upper margin of the mouth is straight, not curved, and the eye is median, not anterior. Other differences are that the anterior vomerine tooth, or teeth, are abruptly longer than the others, and the throat is blackish, with a broad yellow median band. There are transverse rows of tubercles on the sides of the belly.

Interorbital width about one-third expanse of supratympanic ridges; from end muzzle to interorbital point 1·5 times from latter to concavity of posterior margin helmet. From bony orbit to tympanum equal from latter to angle of helmet.

Orbital fissure ·75 long (vertical), diameter membranum tympani, which latter is double width of same. Margin of helmet behind, medially slightly elevated. Muzzle flat with a short terminal dermal process; eyelids with a marginal prolongation. Head slightly granular above; body smooth above; oblique rows of tubercles on forearm. Belly closely, throat sparsely, granular. Both fingers and toes with rudimental web. A large palmar tubercle; two indistinct metatarsal tubercles, the inner elongate. A fold along tarsus and outer toe; slight dermal margins on all the toes. A similar fold on forearm and outer finger, and on the other fingers.

		In.	Lin.
Length	head and body to vent	2	2·
"	of casque on mediad line; least		10·5
"	" " " " greatest		13·25
"	hind limb	2	11·5
"	foot	1	4·5
"	tarsus		7·

* Journal Academy, 1866.

Length forelimb	1	3·
" hand		7·5
Width between nares		1·5
" " orbits		5·
" casque, superiorly, behind		14·
" " inferiorly, "		16·

Grayish-brown above, dark-brown below; a yellow band from chin to breast; black bands on tarsus and forearm. A black blotch below vent, one above tympanum, one below eye (indistinct on one side), and several smaller ones on edge of upper lip.

From the Napo and Maranon. 6648.

Two specimens of two species of this genus in the Museum of Munich are the only ones known in any Museum besides the present one.

The curious and high degree of ossification of the crania of this and several other Neotropical genera, appears to be a defence to the animals possessing it. When killed in spirits they frequently die with the flexor muscles of the head contracted, and the bony front presented like a shield. This is no doubt an important defense against the bite of venomous serpents, which abound in the regions where they occur. This defence appears, however, to be rather a consequence of such structure than a cause, in a physiological sense; since the majority of the Anura in the Continental Neotropical region, where they are equally exposed to venomous serpents, do not possess it, while the tree-toads of the West Indian district, where venomous snakes are almost unknown, invariably exhibit this extraordinary ossification.

Lithodytes conspicillatus. *Hylodes conspicillatus* Günther, Br. Z. S. Lond. 1859.

From the valley of Quito.

Cystignathus hylædactylus Cope, sp. nov.

A species belonging to the section of the genus characterized by having the vomerine teeth in two arched series on the line of the palatine bones; the digits without dermal margins, and the belly included in a discoid fold of the derm.

A vertebral and dorso-lateral dermal fold, and some shorter ones on the sides, but no large warts or glands on the groin. Muzzle ovate, gradually descending at extremity, canthus rostralis not strong, contracted. Tibia less than half head and body. Ethmoid not ossified to end muzzle. Brown with a dark-brown band at each dorso-lateral fold, and two dark spots on the anterior half of each side. A dark band from axilla to orbit, from orbit to tip, and between orbits. Fore limbs not, hind limbs scarcely cross-barred; femur marbled behind. Belly and throat pale yellow.

The toes have distinct dilatations at the end, but not the fingers; all have strong tubercles below; two minute metatarsal tubercles. Tongue considerably free behind and laterally. Vomerine series not extending exterior to inner margin of nares. Tympanum one-half orbit. Wrist not quite to end muzzle; heel to middle of orbit.

Total length 11·6 l.; of hind limb 16· l.; of gape 3·1 l.; width head behind 4· lines.

From the Napo or upper Maranon.

In spite of its dilated toes this is a true Cystignathus. I also place in this genus Hylodes hallowellii Cope, and Platymantis petersii Steindachner. They are closely allied to each other; the latter by no means a (*Platymantis*) Halophila, a genus which does not occur in the new world.

Bufo naricus Spix.

From the Napo and Maranon.

Bufo andianus Cope. "*Bufo intermedius* Gthr.," Cope, Proc. Ac. N. Sci. Phil. 1862, 376, nec *Guentherii*, hinc *Phyrnoidis intermedius* Cope, l. c.

Cranium with the curved orbital margin elevated into a ridge, and continued into a strong supratympanic ridge; a short preorbital ridge, no postorbital. Parotoid gland divergent towards the sides, elongate triangular narrow, continued into a lateral dermal fold. Two metatarsal tubercles, both small; a smooth-edged tarsal fold. Tympanum distinct, less than half diameter of eye. A trace of a parietal branch ridge on cranium. Canthus rostralis very strong, concave short. Muzzle elevated, profile vertical, not as long, in a straight line, as the long diameter of eye fissure. Nostril terminal. Greatest width of head 2·6 times in length head and body; length foot without tarsus 2·75 in same. Hind foot, outer toes with last phalanges only free; $3\frac{1}{3}$ of median free. Heel to hinder edge orbit. Skin covered with small round tubercles above. Palms and soles rough, and limbs generally, metacarpus with two strong tubercles. Half the femur included in the skin of the body.

Gray above, with small paired dark-brown spot on each side the median line; these are more or less confluent, and have a few smaller spots external to them. Sides below lateral fold brown-marbled. Lip with two brown spots on each side, a large brown spot on each side tympanum. A brown band across eyelid and verter. Pale below, with brown blotches on breast and belly.

	Lin.		Lin.
Length head and body	19·5	Length tarsus	4 5
" " includ. tympanum	5·4	" long toe	7·5
" tibia	7·4	" hind limb	23·

Several specimens (No. 6712) from the valley of Quito. Originally brought from Carthagena, New Grenada. (No. 4350 Mus Smithsonian.)

This species is nearest the B. agua. It differs in its very much smaller size, being one-eighth or tenth the bulk of the latter, in its relatively smaller and narrower parotoid glands, and in its pinched, narrow, angulate muzzle. It is also near the B. diptychus Cope, a still smaller species. In the latter the toes are much less palmate, the muzzle longer and the parotoids broader.

Bufo agua Daud. *B. marinus* Schneider.

From the Napo and Upper Amazon.

RANIFORMIA.

Atelopus longirostris Cope, sp. nov.

The muzzle prolonged, the ethmoid cartilage overhanging the labial border, and forming an acute-angled prominence. The muzzle a little longer than the long diameter of the eye ball; nostril just behind a lateral projection formed by the extremity of the prefrontal. Canthus nostralis a right angle, lores nearly plane, upper profile entirely plane, transversely a little concave in front of the orbits. Greatest width of head behind nearly one-third length from end muzzle to end coccyx. Extended backwards the fore limb extends beyond the vent; forward the hind limb measures to the front of the orbit with the heel. Toes about half webbed, the inner quite rudimental; fingers slightly webbed, the inner short. Skin above and below entirely smooth, a line of granular elevations along the side. A faint tarsal fold; metatarsal tubercles not developed. Ostia of eustachian tubes, each half an inner nostril; latter small lateral. Tongue narrow, elongate. One large round metacarpal tubercle. Total length 10·6 lines. From nostril to posterior extremity supratympanic ridge 3·3 lines. Total length fore limb 6·6 lines; of hind do. 13·1 lines; foot 6 lines; tarsus 3·5 lines; extent of sacrum 3 lines.

Above black; under surfaces and upper lip yellow. A greenish spot on each scapular region, and two or three pairs of the same on each side the vertebral line. Femur behind yellow, with a proximal longitudinal, and two distal transverse black bands. All the toes blackish, thumb yellow.

From the valley of Quito.

This species is in general appearance somewhat similar to the A. varius, from Central America, but that has a relatively longer body and shorter limbs and head, and lacks the singular nasal appendage. In this species the clavicles and coracoids are considerably more divergent. It constitutes among Atelopodes, an approximation to Rhinoderma.

In the writer's examination of the Families of Raniform Anura* the genera Atelopus and Phrynidium were accidentally retained as distinct, as was done by Günther, the fact having been lost sight of while correcting the proofs that Peters had shown them to be identical in the structure of the auditory apparatus. I do not think it probable that they should be retained as distinct on account of the remarkable difference in the degree of ossification of the ethmoid, which I have there pointed out.

The structure of the sternum in Atelopus longirostris throws much light on that of the genus Hemisus, discussed in the essay above quoted. The latter genus ought probably to have been compared with Phryniscidæ rather than Engystonmidæ. I have already shown† that the clavical and coracoid are not in contact in Atelopus, but are connected by a simple longititudinal cartilage. This is the structure in all the Phryniscidæ I have examined, and is quite different from the truly Raniform character of the Dendrobatidæ and Colostelthidæ. This elongation of the confluent epicoracoid cartilages—for such is its homology—reaches its greatest extent in the family, in Atelopus longirostris, making a distant approach to what is probably the condition in Hemisus. The anterior transverse element of the latter genus is therefore probably rather clavicle than coracoid, as suggested above.

ATELOPUS LÆVIS Cope. *Phrynicus lævis* Gthr. Catal. B. M.

From the valley of Quito.

RANULA AFFINIS ? *Rana affinis* Peters, Monatsberichte, Berlin Acad.

This may be Peter's species, though the latter is so briefly described that it is not readily identified. Having examined the type in Berlin, I am not prepared to agree with its learned describer that it is a climatal variety of Rana temporaria.

Dr. Steindachner recognizes this genus,‡ but renames it *Pohlia*, and gives it a character of cartilaginous "Stirnbeine" in front, rather than cartilaginous ethmoid.

The genus Ranula turns out to have simple terminal phalanges as in Rana, therefore three of the species formerly assigned to it by me, which have T-shaped phalanges must be regarded as belonging to another and unnamed. genus. This I call TRYPHEROPSIS and refer to T. chrysoprasinus m. as the type. It represents the Hylarana of the Old World, and bears the same relation to Ranula that the former does to Rana.

Size and form that of Rana clamitans, but with small membranum tympani—equal to orbit, and 1·5 length of muzzle. Toes palmate to near end of last phalange, to basis of the same of longest toe. Head plane above, fronto-parietals broad without posterior crests, equal between orbits the length of ethmoid cartilage. Canthus rostralis sharp, loreal region concave; muzzle truncate in profile. Prefrontal bones three times as long as wide. Vomerine teeth in two small fasciculi, exactly between inner nares, nearer to each other than to the latter. Nares considerably less than ostia pharyngea. Outer nostrils half as far from end of muzzle as from orbit. Skin everywhere smooth, except a few minute granulations on posterior pelvic region. Fingers elongate, the inner longer than the second, all with a narrow dermal margin. When extended, the bases of the metacarpals mark the end of the muzzle. The hind limbs extended, nearly measure to the end of the muzzle with the heel.

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* Journ. Ac. Nat. Sci. 1867, 189.
† Nat. Hist. Review, 1865.
‡ Characterized Proc. Academy, 1866, 129.

Length of head (to opposite hinder margin tympanum) 14 | 5 times in length, vent equal width of head behind.

	In.	Lin.
Length head and body	2	6·5
" of muzzle to orbit		4·6
" of fore limb	1	6
" of hand		8
" of hind limb	3	11·5
" of foot	1	10
" of tarsus		8

Color above light olive, with a few small black spots on the pelvic region. A black line on canthus rostralis on edge of upper lip and one round tympanum. Femur and tibia each with two narrow black cross bands. Numerous black spots on groin and front of femur. Femur and tibia behind closely marbled with deep black. Tarsus and fore arm black below. An indistinct yellow band from nostril to axilla.

Two specimens from the Napo or Upper Maranon.

This species differs from the R. palmipes of Spix, according to the complete description of Steindachner in having a considerably shorter and more truncate muzzle. In the last named the nostril is equidistant between muzzle and orbit, and the diameter of the latter is one half the same distance; in this species it is two-thirds. Our species has the thumb longer, and the black marbling of the femoral regions is probably characteristic, as Steindachner does not mention it.

How it differs from the R. affinis (*Rana* Peters) the description of the latter author does not furnish the means of determining. The latter has the same obtuse muzzle.

GYMNOPHIDIA.

Cæcilia pachynema Günther, Proc. Zool. Soc London, 1859.

Two specimens from Guayaquil. They have 170—180 annuli respectively. In the larger the eyes are distinct; there are eight teeth on each side the upper and six on each side the lower jaw, with five vomero-palatines on each side. In the smaller specimen the eyes are invisible; in both the narial valvules are present on the tongue. Günther did not find these, nor eyes, and counted only 5 | 3 | 3 teeth. He describes blue spots on the sides; these are accidental and dependent on the condition of the integment.

Siphonops annulatus Dum. Bibron.

From Lower Napo or Amazon.

The whole number of species brought by the Expedition is:

Crocodilia	1	Ophidia	34
Testudinata	3	Batrachia	16
Sauria	19		—
		Total	73

These are from three distinct faunal districts—those of the Western Coast, the Table land of Quito, and of the Eastern Slope of the Andes. The number of species found in each is as follows:

Western	27
Table Land	16
Eastern	44

In the Western district are five species which occur in Brazil, and one (Chelydra) which extends from Mexico to the cold regions of North America. Two species of the same list occur in Middle Mexico. Of the species from near Quito, four occur in the Western List, and four also found in Eastern Brazil; one is common in Middle Mexico. Of the species of the Eastern list, the Sauria were chiefly obtained from points within the limits of Equador, and the Ophidia from near the Brazilian frontier. Of the last, twelve are also

Eastern Brazilian; of the first, and Batrachia, seven are found in the latter region.

Of generic types none of any extent appear to be restricted to either of the Western regions. Trachyboa with one species does not probably occur out of the West Coast region. Euspondylus, so far as known, is confined to the elevated regions and the adjoining Eastern and Western Slopes. Teleuraspis is largely developed in Central America and Coniophanes in Mexico. Of the genera of the Eastern district, Centropyx, Teius, Hypsibatus, Hyla, Pithecopus, Hypsiboas, Ranula, Himantodes, Olisthenes and Typhlops, have not been brought either from the Table Land or the Western district. The absence of Hyla has been already noted by Günther.

The sources of information respecting the cold blooded vertebrates of Equador are the collections of Fraser, made in the Western district, and identified and described by Günther in the Proc. Zoological Soc. London, 1859; and the collections of the Prussian Consul Reiss, published from time to time by Peters in the Monatsberichte of the Berlin Academy.

Fraser procured forty-nine species; to this number Peters added four, and the present enumeration four. The new species of the present list are mostly from the Table Land and Eastern region, and number twenty-four.

Additional descriptions of Neotropical Reptilia and Batrachia not previously known.

TESTUDINATA.

DERMATEMYS Gray.

This genus presents a peculiarity of the skeleton which has never been noticed. This is, that the vertebral elements of the carapace are not prolonged to the posterior marginal bones as in Emydidæ* but terminate so as to allow of three costæ uniting in a median dorsal suture. This character has heretofore been supposed to characterize the Cinosternidæ, which also lack the mesosternal bone. In this genus the mesosternal is well developed. Cistudo has, however, the last pair of costal bones joined by suture, and in the same family. Claudius Cope, is another genus possessing the same character. It is a character also of the genus Hydraspis.

The genus Pelomedusa Wagler I have shown† to possess only two series of phalanges instead of the usual number, three. It is on this account as separate from the other Pleurodira, as Testudo is from the remainder of the Cryptodira. On this ground I consider it to represent a family hitherto unnoticed—the Pelomedusidæ.

Sternothærus Bell possesses an important structure hitherto unobserved. As in the extinct genus Pleurosternum; the hyosternal bones are divided transversely, giving ten bones to the plastron instead of eight. It therefore represents a family which I call the Sternothæridæ, representing among the Pleurodira the extinct family Pleurosternidæ among the Cryptodira. It may be here mentioned that I have found a fine new Pleurosternum—Pl. pectorale m.—in the cretaceous Green Sand of New Jersey.

The above facts confirm the supposition of Agassiz that the Pleurodira would be found to constitute a series of families, rather than one family.

One species of Dermatemys, the D. mavei, is recognized by Dr. Gray as inhabiting Venezuela and Mexico. The same species, according to the same author, has been subsequently named Emys berardi by Prof. Duméril. I have not had an opportunity of seeing South American specimens, but the excellent figure and description of Gray render it certain that the individuals from that country on which the species was based really belong to another species from those of Mexico. The collections of the Smithsonian Institution

* Agassiz states—Contrib. Nat. Hist. U. States i, that in all Emydidæ the vertebral series of bones is uninterrupted.

† Proc. Ac. Nat. Sci. Phila., 1865, p. 185.

furnish another species from Belize, which I have heretofore identified with the same.

The species may be thus distinguished.

One gular scute, no intergular; five inner marginals, the posterior triangular, not in contact with the femoral or abdominal. Abdominal narrower than pectoral or femoral. Sternum little emarginate behind. Vertebral scuta broader than long, the median except behind covering a keeled ridge........ ABNORMIS.

One gular, and an intergular behind it; four or five inner marginals, the posterior in contact with femoral and abdominal; when only four, the median elongate; vertebral scuta much longer than broad; no dorsal keel. Abdominal scuta equal or wider than those adjoining........ BERARDII.

Two gulars, no intergular; four inner marginals, the median shorter than the hinder, joined as in the last; abdominal as in the last; vertebrals much longer than wide, no dorsal keel. Sternum well emarginate behind........ MAVEI.

DERMATEMYS ABNORMIS Cope, sp. nov.

The greatest breadth of the vertebral plates exceeds the length of the costals; the length of the same equals the width of the anterior costals, exceeding the width of the posterior. The form of the head is elongate, and acuminate; there is a strong basal angle all round the mandible below the cutting edge. Though the carapace measures seven inches in length, the costal bones are only united for half their length, and the hyo- and hyposternal bones are entirely separated from the marginals. This lateral fontanelle is eight lines wide medially. The plastron is well developed, except a very small fontanelle at the middle of the hyo-hyposternal suture. This, with the wider vertebral shields, indicate a young animal, and though there are no signs of immaturity about the head, it doubtless is such. Nevertheless, I cannot suppose the vertebral scutes become as narrow, nor the carapace as fully ossified at maturity, as in the other species, and its distinctness is confirmed by other characters as given.

Above light brown, below and inner faces of limbs light yellow.

Length of plastron 5 in. 9 lin.; width of same at axillæ 3 in.; at posterior end 11·5 lin.; total width at groin 5 in. 5 lin.; length head from behind ear 17 l.; greatest width head 1 in.

From Belize River, Yucatan. Museum Smithsonian, No. 6545; from Dr. Parsons.

LACERTILIA.

PROCTOTRETUS Dum. Bibr.

PROCTOTRETUS PRASINUS Cope, sp. nov., of the group *Rhytidodira* Gird.

Head broad, short, vertex and front plane longitudinally and transversely. Canthus rostralis strong, loreal region concave. Nostril just below the edge of the canthus. Scales of head above smooth, angulated. A transverse scale behind rostral; a united pair of supranasals, the larger divided internasals between the smaller longitudinal posterior supranasals. Three pairs frontonasals, the two anterior in contact with canthal row, and separated by four scales; the posterior largest, and in contact. No superciliary series, except from the frontal backwards; frontal little longer than broad. Occipital (= interparietal) small, in contact with superciliary rows, and followed by two plates a little larger. Occipital and temporal regions covered with rather large, smooth scales, those of the latter smaller, and rounded behind. Supraorbitals of irregular size, smooth, the three inner larger, little broader than long; together three rows scarcely separated within by a series of small scales. Two marginal rows. Three loreal rows, the lower continued below the suborbital. Labials 5—6; two rows infralabials, the inner shorter, of broader scales, the first pair in contact. Auricular meatus large, no marginal scales.

Scales of dorsal region small, not larger than ventral, little larger than lateral, not longer than broad, with a keel on the distal half and obtuse mucro. They are in series, which converge upwards and backwards. Sixty-nine series from rump to occiput; fourteen across the nape. A broad granular band extends from the ears to more than the length of the humerus behind the axillæ. A pair of longitudinal folds extend from above and below the meatus, and unite half-way to the axilla, to which point the single fold extends. Another extends along the side.

Lateral and abdominal scales smooth, the latter rounded, smooth, occasionally slightly notched; gulars entire; caudal scales small, in whorls, strongly keeled. Extended fore limb reaches ·66 to groin; hind limb to union of side folds of neck.

	In.	Lin.		Lin.
Total length (tail mutilated):	5	11·2		
Length to vent.........	2	7	Length to orbit.................	2·5
" axilla.......................		11·5	Width of head..................	5·5
" meatus of ear...........		7	Length of pes.............	10

Color above brilliant green, with a double series of black dorsal spots, with angles projecting laterally, which posteriorly meet similar angles from a lateral series of larger deep black spots. The green continues as a band to orbit. A series of vertical black bars on sides; limbs green-black, cross-banded; tail brown-black ringed; top of head black, brown and green specked. Lower jaw black-barred. Belly light green.

From 603. Museum Comparative Zoology, Cambridge. From Chili.

LIOCEPHALUS Gray.

Having had a large number of individuals of this genus at my disposal, as the species are but little known I give the following synopsis. Gray, who gives the fullest list (Catalogue Sauria Brit. Mus. 1845), enumerates five. There are at present fourteen known.

I. Several series supraorbital scales; no transverse plates. Abdominal scales smooth.

L. ornatus Gray, Catal. L. trachycephalus Dum., Catal. Method. The former from Guayaquil, the latter from Bogota.

II. Transverse series of plates on the supraorbital region; abdominal scales smooth.

α. Parietals and interparietals united.

Supraorbital region scaled in front; a black spot on throat. Gallapagos Is...... .... L. grayi.

αα. Parietals and interparietals distinct; the former transversely divided.

Three pairs frontonasals; three interparietals; a black spot on throat. Equador....... .... L. iridescens.

αα. Parietals and interparietals distinct; the former longitudinally divided.

β. Four pairs frontonasals (four rows plates across front).

Outer parietals larger than inner; interparietal short, triangular; two rows scales above infralabials; tail crest high. Brown, with many light cross-bars .... L. eremitus.

ββ. Three pairs frontonasals.

γ. Outer parietals much larger than inner.

Top of head smooth; plates of front wide; interparietal long and narrow; one row above infralabials. Light olive. Bahamas, Cuba........................ L. carinatus.

γγ. Outer parietals narrow, equal inner.

L. vittatus Hallow. and L. macropus Cope, both from Cuba. L. schreibersii (*Pristonotus schreibersii* Gravenhorst, not *L. schreibersii* Gray = L. vittatus), and L. melanochlorus Cope, from Hayti.

ββ. Two pairs of frontonasals.

Scales smaller; temporal scales small, keeled; of front much keeled; auricular scales elongate; interparietal very small. Hayti...... .... L. raviceps.

Scales larger; temporals large, smooth; auriculars short, thick; scales of front little keeled. From Hayti .... L. personatus and L. trigeminatus.

The last two are much alike in structural features, but differ greatly in coloration; they do not appear to be sexes of the same animal, as I have seen both ♂ and ♀ of the latter.

III. Transverse series supraorbital plates; abdominal scales keeled.

Scales on nape in 5—1—5 rows; seven supraorbitals; frontal scales many, keeled.

L. herminieri Dum. Bibr., from Martinique.

I am not acquainted with L. macleayi Gray, from Cuba; it is probably allied to the L. carinatus and L. vittatus.

Liocephalus eremitus Cope, sp. nov.

Head moderately elongate, profile an inclined plane. Front with four cross-rows of plates posterior to supranasals, the posterior smallest; two pairs of internasals, separated from each other, the anterior from the rostral also; the posterior pair of the same in line and continuous with the divided frontal. Interparietal very short, the parietals largely in contact behind, the outer twice as wide as the inner. All the scales of head smooth, except the supraorbitals. The latter weakly keeled, six on each side, separated by one row scales from supraorbitals; also by one row small scales from superciliaries. Parietals bounded externally by two rows larger scales, then minute scales, then medium keeled preauriculars. Auricular scales elongate, four. Postauriculars not granular. Scales above large, eight rows on median nuchal region. Dorsal crest high on tail, elsewhere moderate. Lateral and abdominal scales smaller than dorsal. Scales of lower surfaces entire, the preanals smaller, keeled. The muzzle marks the end of the metacarpus on the extended fore limb, and the front of the orbit the longest toe. Tail moderately compressed. Folds of side of neck strong; two oblique, one nearly horizontal. Scales of tail shiny, keeled below except at basis.

Coloration plain. Ground dark olive-brown, with a deep brown dorso-lateral longitudinal shade, connected by numerous indistinct cross-bars, which are light margined behind. Lower surfaces brown, with numerous scattered whitish scales, which are most thickly gathered on the pectoral region. A dark brown spot between eye and ear.

	In.	Lin.
Length from end muzzle to vent.....	2	5·5
" " to ear..................		8
" of hind foot....................		13·5
Width of head..		6

One specimen of this species was sent to the Smithsonian Institution by W. J. Rasin, from the island of Navassa, W. I., which lies to the south-west of St. Domingo, in line with Jamaica.

LIOCEPHALUS SCHREIBERSII. *Pristonotus schreibersii* Gravenhorst, Nova Acta Curios. xviii, 739. Tab.

This species is not anywhere described in the English language. I therefore append the following, which I took from specimens in the Mus. Leyden:

Crest very long, equal; scales longer than high, other sc. small, keels not prominent. 7—1—7 sc. on nape; on rump, 7 or 8—1—7. Smaller lateral sc. in a not wide band. Abd. sc. in 23 rows, rhombic. Sc. from ear to shoulder granular; tail compressed. Extended hind limb, near to ear. Interparietal narrow; 8 supraorb. Superceil. not separated. 3 pair frontonas., the poster. often double; 4 in the median row; the frontonas. as broad as long. Head sc. keeled.

Olive-brown; with or without traces of a light band on each side of back, which are most distinct on tail; sides with a band of brown speckles. Green below, with 4 or 6 cross-bands of blue-white bordered spotlets; obsolete anteriorly. Bluish on gular region. Head lighter, uniform; feinus with two transv. series of spots? Fem. with 2 longit. dors. stripes, and a distinct one on lower part of each side. Transverse angulated brown bands behind white border, from side to side. A yellow band on post. face of femur. Dors. crest very small, scarcely on tail. Head sc. broad, keeled.

CELESTUS Gray.

Catal. Lizards Brit. Mus., 117.

This genus, in my opinion, embraces the Diploglossinæ, with normal extremities, in which the frontonasal plates are fused together in one shield; it therefore includes most of the species of Diploglossus, as understood by Gray. Diploglossus was originally based by Wiegmann on D. monotropis and D. fasciatus, species in which the frontonasals are quite distinct. Both are from the South American continent; the first-named is the type of *Camilia* (*C. jamaicensis*) of Gray. The correspondence of the Smithsonian Institution has procured numerous additions to this genus, which are here added:

A. Internasal plates confluent with frontonasals.

I. Scales in 32—6 rows.

Two frontals, one above the other; two postnasals do.; scales all 8—10 keeled; olive, sides black-spotted, STEINDACHNERI Cope.

One frenal and postnasal; scales smooth in front, keels increasing to 16 on tail; sides and limbs black; above olive, the scales black-edged...................... CHALYBÆUS Cope.

Keels of the scales eight to ten; one postnasal, two frenals, both on labials; meatus of ear large; anterior limb two-thirds head. Brown, with blackish band on upper part of each side..... .... PLEII Dum. Bibr.

Keels of the scales eleven, all equal, on posterior regions; anterior scales smooth, together in 36 rows; nasal plate extending to rostral; two loreals, both higher than long; ear minute, head and limbs very short, latter ·75 former, and ·2 from axilla to groin; a blackish lateral band above, cross-lined before, spotted behind.. DEGENER Cope.

Keels of the scales fifteen, all equal; one postnasal, two frenals, both on labials; ear meatus small. Serpentiform, fore limb five-sixths head. Brown, with dark lateral band above............................... SAGRÆ Coct.

II. Scales in 41—2 rows.

Keels 14; none larger; head narrow, sharp, muzzle longer than interorbital width; front plane; parietal separated from supraorbitals by two plates, loreal longer than high; gray, sides black, cross-banded; loreal higher than long ... . PHOXINUS Cope.

Keels 15, a median stronger; front convex; distance between orbits in front equal length muzzle; both loreals higher than long; one plate between parietal and supraorbitals; brown, a deep brown dorsolateral band, and numerous longitudinal series of brown spots on the back.............................. WEINLANDII Cope.
Keels 25, none larger; head flat, acute, muzzle longer than interorbital width; many close, short bay stripes; loreal higher than long......................... BADIUS Cope.
Keels 25 to 35, one median much stronger; head shortter, obtuse, muzzle equal width between eyes; unicolor, with vertical lateral bars; two loreals, longer than high.. STENURUS Cope.

III. Scales in 49—51 rows.

Keels 34—8, the median stronger on dorsal region; form stout, fore-limb one-third longer than head; tail much compressed; yellow or light brown, with about fifteen brown cross-bands......................... OCCIDUUS Shaw.
Keels 17, scales with a cross elevation and marginal depression, making rows of pits; head wide, muzzle short, equal interocular width; tail cylindric; brown, with 18 cross-bars on dorsal region .... IMPRESSUS Cope.
Keels 19, equal, scales plane; head elongate, narrow, muzzle longer than interocular width; brown, with 14 cross-bars on back .... ?STRIATUS Gray.

AA. Internasal plates separate, small.

Scales in twelve longitudinal series on the dorsal region, with fifteen striæ and a weak median keel; body anguiform, anterior limb long as head. Pale, with numerous short longitudinal reddish bands. Otherwise as C. occiduus." Dum. Bibr........... OWENII D. B.

Species unknown to the writer: C. hewardii Gray, Catal. l. c., from Jamaica, and C. macrolepis Gray, l. c., West Indies.

Synopsis of Species.

C. STEINDACHNERI Cope. *Diploglossus* Cope, Proc. Ac. N. Sci. Phila. 1864. Vera Cruz, Mexico. Mus. Smithsonian.

C. CHALYBÆUS Cope. *Diploglossus* Cope, l. c. 1866. Vera Cruz, Mexico. Mus. A. N. S.; Smithsonian.

C. PLEII m. *Diploglossus* Dum. Bibr., v, 605. *Do.* (*oneyda*) Gray, Catal. *Hab.*—Martinique (Mus. Paris).

CELESTUS DEGENER Cope, sp. nov.

This is the most Seps-like of the genus, having shorter and weaker limbs than the C. sagræ, and a shorter and broader head. The toes are very short, though of the normal number; it perhaps will approach the genus Sauresia Gray.

Width between fronts of orbits 1·5 times in length of muzzle anterior to same. Length of head to middle postparietal plate equal width of same at ear openings. Width of frontal plate behind greater than length of the same. Supraorbitals five, separated by two scales from parietal. One preocular; two loreals, both higher than long; an elongate oblique postnasal in contact with anterior supranasal. Nasal meeting rostral by a suture. Eight upper labials, fifth and sixth supporting a long suborbital, which is convex below. Two rows of infralabials, the upper of longer, lower of wider scales. Toes short; behind, fourth much shorter than first. Whitish below; chin reticulated with brown. Sides with longitudinal brown lines, the upper confluent, much darker, and with a zig-zag upper margin. Above, fawn brown, with seventeen cross lines to middle of back, and small brown spots in quincunx behind them. Tail with a deep brown band on each side.

	In.	Lin.		In.	Lin.
Length to vent	3	2.25	Length fore limb		4·6
" to axilla		11.75	" hind limb		7·
" to ear		5·6			

A single specimen of this interesting species is contained in a collection from Porto Rico, West Indies, sent to the Smithsonian Institution by George Latimer, correspondent at that island.

C. sagræ. *Diploglossus* Cocteau, Hist. Isle Cuba, Dum. Bibr. v, 602.
Hab.—The whole of Cuba. Mus. A. N. Sci.; Smithsonian.

Celestus phoxinus Cope, sp. nov.

A fusiform species, the body rather stout and flattened, the outlines tapering gradually to end of muzzle and tail. Head flattened, with strong canthus rostralis, and concave loreal region. Postnasal and postloreal longer than high: preloreal higher than long. Five supraorbitals; scales behind postparietals not larger than those of the nape. Dorsolateral angle strong on scapular region. The eighth upper labial is the first one angulated above; rostral plate broad and low. The limbs, when pressed to the sides, fail to meet by the length of the hand. Keels of the scales strong. Tail slightly compressed.

Above light gray; sides from orbit to groin dark brown, with regular vertical brown bars, which are margined behind by a close series of light spots. Two series of small brown spots on each side the dorsal region, the median stronger on the nape, all vanishing behind. Below immaculate; limbs with brown light-edged cross-bars.

	In.	Lin.		In.	Lin.
Length to vent	3	3·	Length to orbit		3·
" to axilla	1	2·8	Greatest width head		4·8
" forelimb		8·6	Length hind limb	1	0·1

This elegant species was found by Dr. D. F. Weinland, near Jeremie, Hayti, and was placed by him in the Museum Comparative Zoology, Cambridge, Mass., in care of Prof. Agassiz.

Celestus weinlandii Cope, sp. nov.

This species is near the last, but is less regularly fusiform; the body, and especially the head, are less depressed; the canthus rostralis is depressed and the loreal region plane. Both loreals higher than long, and the seventh upper labial is the first angulated above. Rostral deeper, rounded above. Five supraorbitals, separated from parietals by but one plate besides fronto-parietals. Auricular opening small. Limbs when pressed to sides meet. Larger median carina of scales wanting on those of anterior nape and tail. Vent with three cross rows, rather larger scales in front.

Below the dorsolateral brown band is another formed of spots in line: they continue with a vertical series of brown spots on the sides. Ground above dark brown; sides of neck and gular region brown-lined. Limbs with brown reticulations.

	In.	Lin.		In.	Lin.
Length to vent	3	6·8	Length fore limb		9·7
" to axilla	1	4·	" hind limb	1	2·4
" to orbit		3·	Width head		5·9

This species is found on Gonave Island, on the western side of Hayti. Mus. Smithsonian. From T. Younglove. Named in honor of Dr. F. Weinland, M.D., of Frankfort o. M., who has contributed much to the history of the Reptilia of Hayti.

Celestus badius Cope, sp. nov.

This species, though larger than either of the preceding, possesses a more acute muzzle; the front is plane as in D. phoxinus, but the snout lightly convex, though less so than in D. weinlandii and with obtuse canthus rostralis and plane loreal region.

The (sixth or) seventh upper labial is the first angulated above, while the suborbital and lower postorbital plates are shorter and deeper than in the preceding species; both loreals higher than long. There are two plates besides the fronto-parietal between parietal and the posterior of the five supraorbitals.

The limbs are short, and when pressed to the side fail to meet by the length of the hind foot. The digits of the fore foot are relatively shorter and weaker than in the two species preceding.

The eye fissure is small, measuring 2·5 times from its hinder margin to the ear; but twice in the D. weinlandii; it is less than double the diameter of the meatus. Transverse series of scales, from groin to above middle of meatus, ninety-four; those of the tail keeled like the rest. Three rows larger preanal scales.

	In.	Lin.		In.	Lin.
Total length (?tail reproduced.)	8		Length fore limb......		9·
Length to vent......................	4	1·	" hind limb		13·5
" to orbit		4·5	" hind foot..		6·3
Greatest width head.		7·5			

Ground color cream, almost obscured above by many longitudinal bands and lines of bright bay; these are more or less broken up, of irregular width, and often confluent. Top of the head and sides closely spotted with bay, on the latter region in a longitudinal direction or in lines directed obliquely downwards and forwards. A dorsolateral band of ground color extends from superciliary region, more or less completely to the iliac, and is bay margined below and sometimes above. Throat and belly uniform yellow. Limbs bay red with white spots.

From Island of Navassa, W. I. From W. J. Rasin.

The collection sent to the Smithsonian Institution from this small Island consists of the following species:

Typhlops sulcatus Cope,
Ungalia pardalis Gosse,
Liocephalus eremitus Cope.
Metopocerus cornutus Wagl.,
Celestus badius Cope,

Celestus stenurus Cope. *Diploglossus* Cope, Proc. A. N. Sci. Phil. 1862.

From near Jeremie, St. Domingo. Mus. Compar. Zoology, Cambridge.

I append a description of another specimen, referred to this species with doubt.

This is a large species with broad head, and short muzzle, the latter being shorter than the width between anterior margins of eye fissures. First upper labial angulated above the seventh; suborbital and lower postorbital elongate, narrowed. Nasal very small; preloreal higher than long, loreal nearly square. Front convex, canthus obtuse. Eye fissure one-half distance to meatus of ear.

Eighty transverse rows scales from above meatus to groin. Supranasal plates small, narrow, the posterior nearly divided by the anterior (right) angle of the elongate internasal. Scales with from 26 to 35 keels, a median one rather stronger on some. Two scales bound the parietals in front besides the fronto-parietals. Four rows large scales in front of vent. The limbs pressed to the sides nearly meet.

Light-brown, with three rows of small subquadrate dark-brown spots on the median dorsal region. Limbs brown with light spots arranged in indistinct cross-bars. Head above light-brown with darker shades; labial plates above and below broadly brown margined. Below immaculate.

Length to vent 5 in. 9·7 lin. To orbit 5·1 lin. Width head behind 9·6 lin.

A number of digits in this single specimen exhibit a loss of the claws, others have lost one, two or three phalanges. This may have a natural cause, since the allied genus Panolopus is deprived of these members entirely, though with well developed limbs.

From Gonave Island, near Hayti. From Thos. Younglove. The reptiles found by this correspondent in this Island are:

Homalochilus fasciatus Fisch.,
Dromicus parvifrons Cope. (*D. protenus* Jan),
Uromacer catesbyi D. B.,
Uromacer oxyrhynchus D. B.,
Liocephalus.
Diploglossus weinlandii Cope,
Diploglossus ? stenurus Cope,
Ameiva chrysolæma Cope,
Trachycephalus marmoratus D. B.,
Lithodytes lineatus Grav.,

Celestus occiduus Gray, Catal. *Lacerta occiduus* Shaw. *Diploglossus Shawii* Dum. Bibr., Erp. Gen. v, 590.
Jamaica. Mus. Smithsonian.

Celestus impressus Cope, spec. nov.

This is an elongate species with a tail cylindric for its proximal half, a little depressed at base; the body is quite cylindric and the limbs short. The ear is large and the head abruptly widened at the temples. The muzzle is short and flat, and the superciliary regions are slightly elevated above the frontal plane. Loreal region grooved. Ten upper labials, of which the eighth rises between suboculars. Postnasal distinct, prefrenal much higher than long, frenal square, two preoculars. Scales with equal keels, their hinder halves depressed.

The limbs appressed to the sides fail to meet by the length of the anterior without the hand.

	In.	Lin.		In.	Lin.
Length to posterior edge ear...		10·2	Length fore limb...............		11·66
" to axilla....................		19.75	" hind limb...............		15·3
" to vent.....................	3	8·75	" tail (reproduced)......	5	9·

Color above olivaceous, below yellowish. Back and sides crossed by about 18 narrow brown bars, which are three times broken and alternating on each side the middle line. Tail cross-lined, throat and breast cross-banded less distinctly. Lateral plates, a short band behind orbit, and four quadrate spots above throat and axilla, deep brown.

Two specimens in Mus. Academy from Jamaica, collected by Charles B. Adams.

Celestus striatus Gray, Ann. Nat. Hist. ii, 288. Catal. Brit. Mus. *Diploglossus cliftii* Dum., Bibr. v, 596.
Jamaica. Mus. Academy, Phila.

Celestus owenii m. *Diploglossus* Dum., Bibr., do. (*Oneyda*) Gray, Catal. B. M.
Habitat.—Unknown. (Mus. College Surgeons, London.)

AMEIVA Cuvier.

Ameiva chrysolæma Cope, sp. nov.

Char.—Twelve series abdominal plates: no horny tubercles on the heel; median and lateral gular scales equal. Frontal undivided, supraorbitals four. Teeth mostly bicuspid. Olive with numerous series of white spots, sometimes indistinct on dorsal region. Gular fold black, throat yellow; belly green and yellow.

Description.—One of the larger species. Four parietals and one interparietal, subequal. Two posterior supraorbitals bounded by granules within; frontal in front nearly broad as long; prefrontals longer than broad. Nostril in nasal plate near suture. A postnasal, one very large frenal, two preoculars and two suboculars. Labials 6—7, the anterior in both series very narrow. Infralabials eight in lower series, three in upper behind, all separated from labials by granules. Gular fold margined broadly with granules, with three larger series of hexagonal scales.

Brachials rather small, in seven rows above, and two below, not separated from antebrachials by granules, but joining an area of small scales in seven rows above, and ending in one row of broad and one of narrow antebrachials below. Postbrachials small, three rows larger. Tibial plates in four rows, two on under face, the outer of seven plates, of which the third and fourth are very large. Outer toes just exceeding inner. Femoral pores twenty.

	In.	Lin.		In.	Lin.
Total length	16	9.	Length to orbit		8·
Length to vent	5	5·	" of fore limb	2	1·
" to edge collar	1	10.5	" of hind limb	3	9·
" of anterior claw		3·	" of hind foot	1	10·5

Olive-green with five series of small white spots on each side, and seven on the dorsal region. The latter tend in a smaller specimen to form two pairs of incomplete dorsal stripes. Upper arm and hind leg with small white spots. One or two series white spots on the lateral abdominal scales. Latter blackish olive-yellow margined.

The anterior claws of this species are particularly large, and slightly curved. There are twenty teeth on each maxillary bone, which are nearly all bicuspid, the longest cusp posterior. In one individual there are mingled with these, posteriorly, three tricuspid.

Two specimens sent to Mus. Smithsonian from Gonave Island, on the western side of the Island of Hayti, by Thos. Younglove.

OPHIDIA.

TYPHLOPS Schn.

TYPHLOPS SULCATUS Cope.

This species exhibits most of the characters of the T. lumbricalis. These are, the presence of a preocular plate, the obtuseness of the muzzle plates, four upper labials, a nasal entirely divided by the suture through the nostril, and twenty longitudinal rows of scales.

It differs in the much greater prolongation and depression of the muzzle, and hence more slender form of the rostral and nasal, and greater prolongation backwards of the upper part of the preocular. In the existence of a strong groove along the sutures of these plates, giving the muzzle a trilobate outline from above. In similar deep grooves along the upper sutures of the labials and around the small frontal superciliary and interparietal scales. These scales are not larger than those of the body; a pair in place of the parietals are larger. The body is more slender than in T. lumbricalis, the length of the tail entering it 44·1 times. Tail short, acuminately conic. The length of the muzzle beyond the mouth equals from the nostrils to the opposite side of the rostral plate, or one-half the tail's length.

Color pale yellowish-brown; a darker brown line in the middle of each row of scales, on the anterior third of the length.

Total length 6 in. 5·2 l.; of tail 1·75 l.; greatest diameter 2 lines.

One specimen in Mus. Smithsonian from Navassa Island, southwest from St. Domingo.

UNGALIA* Gray.

Tropidophis Bibr. *Notophis* Hallowell.

Thirty-five individuals, representatives of this genus before me, indicate a greater number of species than are at present recognized by naturalists. Some of the additional ones have been already named and imperfectly described.

All that are known are from the Bahamas, Cuba, Navassa and Jamaica, a remarkably local distribution. They are distinguished as follows:

* The correct spelling of this name is probably Ungualia.

I. Scales in twenty-seven rows, keeled.

Gastrosteges from 200 to 209; five or six lateral rows smooth; yellow with black end of tail.................... MELANURA.

Gastrosteges 169—189, nine or more lateral rows smooth; brown with rows of brown spots; tail not black.... PARDALIS.

II. Scales in twenty-one—five rows.

α. Scales keeled, a larger dorsal row;

Gastrosteges 168; scales in twenty three rows; gray with small dorsal spots.. CANA.

αα. Scales smooth, dorsal rows equal.

Short, stout, gastrosteges 142—150; head lanceolate; scales in 23—25 rows; brown or gray with usually dorsal and lateral spots.................................... MACULATA.

Long slender, head small lanceolate; gastrosteges 202—5; scales 21—3 rows; yellow with nearly complete broad brown rings or half rings......... .. .. SEMICINCTA.

Long slender, head broad short; gastrosteges 211, scales 25 rows; brown with six rows of black spots......... DIPSADINA.

The normal number of postoculars in this genus is three, but variations are not unfrequent. Thus a specimen of U. maculata has but two postoculars on each side, another has two on one side only. Another has a complete circle of five scales round the eye on one side, and three postoculars on the other. I have seen no specimen with two preoculars as in the specimen figured by Jan as *T. distinctus*, but as the species does not appear otherwise different from *U. maculata*, I suspect that this character also falls within the range of the variations of the latter.

UNGALIA MELANURA Gray, *Boa*, Schlegel.

There are two varieties of this species.

α. A narrow brown vertebral line; crown not spotted; (*Notophis bicarinatus* Hallow.), three specimens from Cuba, two of them from the east; one with two keels on the vertebral row, the others with one.

β. (*Boa melanura* Schleg.) Two dorsal series of brown and gray spots, top of head much spotted. Five sp. from Cuba.

UNGALIA PARDALIS, *Boa Pardalis* Gosse, *Ungalia maculata* Gosse.

Var. α. Shorter, gastrosteges 169; eight rows of spots, belly blotched. One sp. from Jamaica (Adams coll.) Smithsonian, 5763.

β. U. bucculenta Cope. Larger, gastrosteges 186—9; four rows of spots, dorsal pairs much confluent, belly specked; head swollen behind. Four specimens from Navassa Id. Mus. Smithsonian. The largest of these measures 25 inches in length.

UNGALIA CANA Cope, sp. nov.

This species is intermediate between the U. pardalis and U. maculata in many respects. Superior labials ten, all higher than long; orbitals 1—3. Internasals longer than broad; prefrontals broader than long; postfrontals pentagonal, nearly equal sided. Temporals 3—3—4. Scales, except six external rows, weakly carinate. Muzzle narrow, acuminate, head rather wide behind; diameter of eye a little over twice in length muzzle. Total length 13 in. 9 lin.; tail 16·5 lines. General form neither very stout nor slender.

Color gray brown above, below yellowish gray, densely punctulated at middle of gastrosteges. A series of tolerably approximated transverso-dorsal spots, which are short, and little distinct, in some specimens almost wanting. On each side on the third row of scales is a series of black dots two or three scales apart. A brown band from eye to side of neck, the labials below it yellowish; mental region yellowish.

Several specimens from the Bahama Island of Inagua sent to the Smithsonian.

UNGALIA MACULATA Gray. *Tropidophis* Bibron. *Tropidophis distinctus* Jan. Elenco et Icongraphie.

α. Two rows large spots on each side, the upper series usually confluent; a large series each side the vent extending half across it; eight specimens from Cuba.

β. Two rows small spots on each side, those of the dorsal rows separate; no large blotches on the belly. Three sp. from New Providence; Bahamas.

γ. Gray without spots or with traces only. Three sp. from New Providence.

In this species two or three labials may enter the orbit irrespective of the number of postoculars.

UNGALIA SEMICINCTA. *Ung. maculata*, var. *semicincta* Gundlach and Peters, Monatsberichte Preuss. Acad. 1864, 388.

This is a handsome and distinct species, described as a variety as above, most probably, though the authors have not noted its essential peculiarities of proportions of body and the number of scuta.

Three specimens (2 Smithsonian, 5746) from Eastern Cuba. Chas. Wright.

UNGALIA DIPSADINA Cope, sp. nov.

This is a long slender species, much compressed, with slender neck, and small flat and broad head; its form is thus more like that of Dipsas than any other of the genus. The anterior upper labials are larger than in the other species, the second reaching to the preocular on one side, and within a hair's breadth on the other. Ten labials on one side, nine on the other, two only in orbit. Oculars 1—3; temporals 3—3—4; internasals and prefontals of equal length; occipitals short, separated by two scales. Eight dorsals, and the basal series of scales larger than the lateral scales, some of the latter slightly roof-shaped. Two pairs of longer genials. The eye is larger than in the other species, its diameter entering the length of the muzzle 1·5 times. The width of the head behind nearly equal its length from the end of the muzzle to near the end of the occipitals. The diameter of the body an inch behind the head, one half that of the thickest part of the body. Urosteges 42.

Color above a deep reddish brown, with a row of black spots on each side the median line about two scales wide, and always distinct, and two alternating rows of smaller black spots on each side. A series of blackish cross-bars on the belly, two and three scuta apart, sometimes divided and alternating, invade the first row of scales; no spots for two inches behind the chin. Head dark above, with a darker spot on the occipital region. Ground color below, yellowish brown.

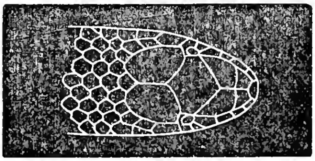
Total length 15·5 in.; of tail 2 in.; of gape 6 lin.

Habitat.—Cuba, section unknown. Discovered by my friend Prof. Poey, of Havana, who sent a specimen to the Museum of the Academy of Natural Sciences.

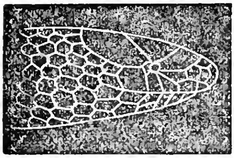
COLOPHRYS Cope, gen. nov.

Teeth equal. Anal shield simple, subcaudals divided. Two pair genials and frontals; no preocular or superciliary, the vertical forming the eyebrow; two nasals. Scales smooth.

COLOPHRYS RHODOGASTER Cope, sp. nov.



Scales broad, in seventeen longitudinal series. Head slightly contracted, obtuse, depressed. Rostral shield visible from above; prefrontals moderate, their common suture little less than that of postfrontals; nasals large, as long as loreal,



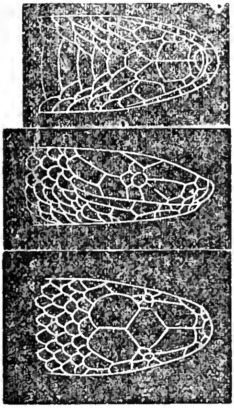
postnasal longer. Vertical (frontal) angulated in front, more acutely behind, where it has two sutures on each side, owing to its confluence with the superciliaries—the exterior being the posterior sutures of the latter. Parietals much longer than wide, only margining anteriorly the whole of the narrow single postorbital. Labials six, all higher than long except the sixth, which only is separated from the parietals by a single temporal. Second superior labial in contact with postnasal and more with loreal; third and fourth with orbit and postocular. Inferior labials seven, five in contact with genials. Scales in contact with parietal, 1 temporal, 4½ squamæ. Gastrosteges 144, urosteges 30; in a second specimen 140—41. Length of largest specimen 12 inches; tail 2 in. 1·5 lines.

Color of upper surfaces a rich slate brown, very iridescent; lower surfaces, including first series of scales with labial and rostral shield, red orange.

Three specimens of this species were brought by Dr. Van Patten from the elevated country in the neighborhood of the city of Guatemala. It bears considerable resemblance to the Catostoma c h a l y b a e u m Wagler, but besides the lack of superciliary shields, its eye is smaller and the head more compressed. In the C. c h a l y b a e u m there are but six inferior labials, of which four margin the genials; it has also shorter nasals, and a vertical more truncate anteriorly.

CATOSTOMA Wagler.

CATOSTOMA NASALE Cope, sp. nov.



This species has, like that preceding and that following, seventeen rows of scales, of which those on the posterior part of the body and tail are weakly keeled, thus differing from the C. c h a l y b æ u m where they are smooth. It also differs much from the same in the elongated form of the head and the great disparity in size between the pre- and postfrontal shields. In this species the former are less than one-fourth the latter in longitudinal extent, and about half in the transverse. The supraorbitals are very small and subtriangular, the vertical broader than long, and what is unusual, as much angulated anteriorly as posteriorly. Parietals longer than broad, the anterior margin touching the postocular and superciliary. Superior labials eight, the last only separated from parietals by a temporal, which is large in two, small in one specimen. First labial very small, third longer than high. Inferior labials seven, four in contact with genials. Seventeen rows of scales, which are small and more crowded above the vent than in any other species. Gastrosteges in three specimens 131—3—4; urosteges in the same 25, 30.

Color above, including labial region and chin, iridescent slate brown; belly and gular region pale yellow. Length of largest specimen 11 in. 1·5 lines; tail 2 in.

This species is probably nearly allied to the C. s i e b o l d i i of Jan, of which but few peculiarities are described. Jan's account of the scutellation indicates a more elongate species no doubt distinct; the scuta vary from g. 146—154, u. 34—8.

Several specimens from near the city of Guatemala, presented to the Smithsonian Institution by Dr. Van Patten. Mus. Ac. Nat. Sci. Phila.

RHADINÆA Cope.

The genus Rhadinæa is nearly coextensive with Henicognathus Jan, and Ablabes Günther. Ablabes of Dum. Bibr. was, however, established on the Coronella r u f u l a of Schlegel, which has the prolonged series of gastric hypapophyses, and is therefore quite different, while Henicognathus is characterized by a peculiar structure of the mandible, which so far as I am aware occurs in onlyone American species, the H. a n n u l a t u s D. B. Consequently the majority of species attached to this genus belong to Rhadinæa, as the E. m e l a n o c e p h a l a D. B. etc. In the description of this last species, three are mingled, as I have ascertained both from a reading of the same, and from an examination of the originals in Mus. Paris. One of these is our R. o b t u s a, the other is the true R. m e l a n o c e p h a l a, which should be described as follows, and the third is a species as yet undescribed, which I call Lygophis n i c a g u s Cope. Duméril and Bibron give both the Island of Guadaloupe and Brazil as habitats of their species. I suspect, however, that the specimen of R. o b t u s a was accidentally introduced into the jar containing the other two, and that it is confined to South America, where it is not uncommon. It is figured by Jan in his Iconographie, as the second specimen of R. m e l a n o c e p h a l a. His first specimen of the same as figured, is our Lygophis n i c a g u s, a serpent with a diacranterian dentition.

The true R. m e l a n o c e p h a l a is probably confined to Guadaloupe and the neighboring islands. Its description has been so mingled with those of the two other species as to require a rediscription. It is to be regretted that this, the type of the species, should not have been figured in the beautiful work of Jan and Sordelli.

RHADINÆA MELANOCEPHALA. *Enicognathus melanocephalus* D. and B., part.

Head broader and shorter. Common pre- and postfrontal suture $2\frac{1}{2}$ times in length, from vertical ant. sut. to end occip. suture, and equal diam. eye. Vertical a little longer than occip. Common sut. occip.= anterior sut. occip. ! Postfront. descending low on (sides of) loreal seg. Loreal longer than high, 8 and 9 sup. lab., 4 and 5 or 4 ? 5 and 6 in orbit; of the 3 behind the 5th or 6th—1st is higher than long, 2d longer than high, 3d and last of all twice as high as long. Temporals 2 | 2 | 2 | the infer. of 1st row between penult. and antepenult. labials. Yellow band round canthus rostralis and upper part of rostr. plate edge of supcil. and across post. part of supcil. and vert.; brown area enclosed. Occips. brown, connected by long. line with broad brown collar yellow edged, which is 6 scales long. Yellow vertebr. band on median row sc. with occasional round brown spot on a single scale, small round spot on end gastrosteges. Labials yellow, edged above with brown. Tail 10″. Total 32″ 5‴.

From Guadaloupe. Mus. Paris.

LYGOPHIS (Fitz.) Cope.

LYGOPHIS NICAGUS Cope. *Enicognathus melanocephalus* Jan, Iconographie Livr. xvi. Tab. 1, fig. 4, (not of Dum. Bibr.)

Length of comm. suture of pre- and postfront. one-third dist. from anter. suture vertic. to end of comm. sut. of occipitals. Vert. long, sides straight, converg., as long as comm. sut. occip. Occip. long, a little divaricate at tips. Diam. eye = comm. suture pre- and postfronts.; 7 sup. lab.; 3, 4, 5 in orbit; 7th largest, higher than long, 8th longer than high. Loreal higher than long. Temp. 1 | 2, 17 r. sc. Below yellow, immaculate, near end of gastrost. a longit. spot, forming together longitud. line. Above this line brown, darker to 4th row of sc., forming band with numerous light points mixed; and on 8, 9, 10 rows where a median longitud. band is formed with undulatory edges and varied with whitish points. On anter. part body the intermediate pale lateral band crossed by vertical brown bars. Dark spot on nape and middle of occips., which are bordered all round with pale and have a pair pale spots in middle (Tropidonotus style.) Superciliar. with a posterior border. Tail 7′′ 7′′′. Total 36′′ 3′′′.

XENODON Boie.

A review of the species of this genus is given by Günther in Ann. Mag. N. History, 1863, 353, in which he enumerates six species. He omits the East Indian species, and places them in Tropidonotus in his volume on the Reptiles of British India,—an arrangement which I had long thought necessary, on account of the hypapophyses of the posterior vertebræ of the latter (vide Proc. Acad. 1864). Jan places Liophis b i c i n c t u s of Dum. Bibr. with Xenodon g i g a s D. B., a closer approximation to nature than any other arrangement. He, however, regards them as a genus distinct from Xenodon, the truth of which position I doubt, and refer them both to Xenodon. The species of the latter genus will then be as follows, two not previously known being added:

I. An orbital ring of scales.

X. b i c i n c t u s. X. g i g a s Dum. Bibr.

II. One labial entering the orbit.

X. i r r e g u l a r i s Gthr.

III. Two labials entering orbit.

α. Eight superior labials.

β. Anal bifid.

X. s e v e r u s L. X. n e o v i d i i Gthr.

ββ. Anal entire.

X. c o l u b r i n u s Gthr. X. s u s p e c t u s Cope, sp. nov. X. a n g u s t i r o s t r i s* Peters.

αα. Seven superior labials.

X. r h a b d o c e p h a l u s Boie.

I have before me, of X. g i g a s two sp., X. s e v e r u s five sp., X. n e o v i d i i one sp., X. c o l u b r i n u s three sp., X. s u s p e c t u s one sp., X. a n g u s t i r o s t r i s four sp.

XENODON SUSPECTUS Cope.

Scales in nineteen longitudinal rows, in transverse series and very imbricate. Body rather slender, compressed, head distinct ovate, plane in profile, the muzzle not depressed or arched. End of muzzle not projecting; eye large, contained $1\frac{1}{3}$ times in length muzzle, and $1\frac{2}{3}$ in interorbital width.

Prenasal more elevated than postnasal; loreal large, higher than long. Two postoculars, the superior considerably more elevated, in contact with one temporal, which is higher than long; sixth and seventh labials higher than long, the seventh not reaching postoculars, separated from occipital by two temporals. Last labial a little longer than high. Supraorbitals each a triangle truncate anteriorly. Frontal nearly long as broad, subtriangular, the occipital sutures being very short. Occipitals very short, subtriangular, sides concave, width equal common suture. Inferior labials 9 (one less than other species); genials, the pairs short, equal. Gastrosteges 134, urosteges 35.

Color: above a bright dark olive, with fourteen blackish cross-bars contracted in the middle, as wide as their interspaces; the ground color appears in the middles of these bars, reducing them to skeletons. Sides of belly black, with irregular bright yellow spots, most distinct on the end of every other scutum. Top of head with ground like the back, and, like it, thickly covered with black specks. Sides of head and of muzzle black, speckled

* Two specimens of this species are in the museum of the Academy, presented by Drs. Gallaer and Le Conte. Two other specimens, of unknown locality, are to be referred to the same.

with yellow, on the temple abruptly bounded above by the olive in a line to rictus. Labial plates with a yellow blotch in the middle. An indistinct brown band on each side the head from the occipitals backwards. Throat bright yellow, with black blotches behind, which continues on the anterior fourth the length. Belly brown, clouded yellow laterally, becoming blacker behind; tail yellow below.

Total length 22 in. 4 l.; of tail 3 in.; of gape 11 l.

This, the brightest species of the genus, was brought from Lake Jose Assu by the Thayer Expedition to Brazil, under direction of Professor Agassiz. M. C. Z. 362.

EUTÆNIA Bd. Gird.

EUTÆNIA PHENAX Cope, sp. nov.

This is a handsome and peculiar species, being the only one of the genus which is cross-banded.

Scales in nineteen rows. All keeled except the first. General form much as in E. sirtalis. Head rather short, muzzle obtuse, eye large, superciliary plates arched. Diameter of eye equal from same to rostral plate along the labials. Frontal shortened behind, with straight sides, ·75 of parietal common suture. Parietals truncate behind. Upper labials eight, fourth and fifth in orbit. Loreal longer than high, one preocular, temporals 1—2. Inferior labials nine, sixth largest; genials equal. Urosteges 63; anal 1; gastrosteges 161.

Total length 23 in. 5 l.; of tail 5 in.; to rictus oris 9 lin.

Coloration. Above reddish-olive, crossed by thirty-six transverse spots, which are of a bright brownish-red, with a narrow black margin. They are separated by transverse intervals of only a scale in width, hence the black margins appear as paired cross-bars. These cross-bars extend to the first row of scales, and are as often continuous on the side as not. There is no lateral stripe, but there are black spots on the corner of the end of the gastrosteges. The margin of the first brown spot is in form of two black lines, diverging from the parietal plates backwards. There is a brown bar in front of frontal, one on the frontal and superciliaries behind (imperfect), and a longitudinal on each parietal. No pair of light parietal spots. Labials below eye with the last black-margined, otherwise light olive. Below, a strong green, unspotted.

This species is common near Cordova, Vera Cruz, whence Francis Sumichrast has sent specimens to the Smithsonian Inst. and Mus. A. N. S.

MASTICOPHIS Bd. Gird.

MASTICOPHIS MELANOLOMUS Cope, sp. nov.

A slender species, with one preopercular plate, and smooth scales in fifteen longitudinal series. Loreal an elongate parallelogram, not encroaching on the preocular. Postoculars two, the inferior very small. Superior labials nine, the fourth, fifth and sixth in orbit, seventh subtriangular, eighth and ninth longer than high. The last mentioned are separated from occipitals by two horizontal series of temporals, each of three plates, the anterior of the lower, and posterior of the upper, the longest, lower posterior widest. Occipitals broadly emarginate behind, their width in front equal the common suture and four-fifths frontal plate. Latter much narrowed; superciliaries broad, projecting. Internasals a little longer than broad, rostral just visible from above. Inferior labials ten, postgenials considerably longer than pregenials. A row of plates in an open chevron bounds the occipitals and temporals behind. Scales of body not narrowed; anal as in the genus, divided.

Gastrosteges 184; urosteges 128. Total length 44 in. 3 l.; of tail 14 in.; of rictus oris 1 in. 1 l.

Coloration grayish-olive, all the scales with a narrow black border, which become longitudinal lines on the posterior part of the length; one of these, on the line of the second and third rows of scales, extends throughout the posterior five-sixths the length. A dark shade through eye. Middle half of gastrosteges yellow.

From Yucatan; A. Schott, of the Comision Cientifica.

I had enumerated this as the M. b i l i n e a t u s of Schlegel (Pr. A. N. S. 1866, 127), but an examination of Jan's beautiful figure enables me to correct the error.

LEPTOGNATHUS Dum. Bibr.

Günther, Jan.

A review of the species of this interesting genus has been already given. I give here references to all the species, and descriptions of some new ones not contained in the Williams College collection.

Leptognathus bucephala Cope, Shaw, see Catalogue.

Leptognathus variegatus Dum. Bibron, Erpet. Gen. vii, p. 477. *Dipsadomorus* Jan.

From Surinam. No specimen of this species has fallen under my observation.

Leptognathus catesbyi Günther, Weigel. See Catalogue.

Leptognathus pavonina Dum. Bibr. Schleg., Erpet. Gen. vii, 474.

Guiana.

Leptognathus articulata Cope, sp. nov. "*Dipsas brevis* Dum. Bibr.," Cope, Proc. A. N. Sci. Philada. 1860. Not of Dum. Bibr.

The most slender, compressed species of the genus. Muzzle very short; frontal plate hexagonal, sides converging, length equal width; occipitals broad and squarely truncate behind, not reached by the vertebral series of plates. Fourth and fifth superior labials entering orbit, sixth nearly excluded by the long lower postocular. Temporals two—three, with one inferior additional in contact with postocular. Sixth and seventh inferior labials connected by one transverse plate.

The brown annuli are wider anteriorly than posteriorly; the second covers $10\frac{1}{2}$ rows of scales, the seventeenth, just in front of the vent, $6\frac{1}{2}$. The yellow annuli are of nearly uniform width—$4\frac{1}{2}$ scales,—and without spots above or below. Top of head, sides, and upper labials in front of eye, all the lower labials, brown; rest of head with numerous short lines on the muzzle, yellow or white.

Gastrosteges 215; anal 1; urosteges 135. Total length 26·5 in.; of tail 8·75 in.; of gape 6 in.

From Veraguas, Costa Rica; sent to the Academy by R. W. Mitchell.

Leptognathus mikanii Günther, Schlegel. *Anholodon mikanii* Dum. Bibr. vii, 1165.

Eastern Brazil.

Body not elongate, but much compressed. Head less elevated, and with flatter muzzle than in the last.

Loreal square; frontal nearly equally hexagonal, with straight sides; occipitals elongate, rounded posteriorly. Third and fourth labials bounding orbits, the anterior little higher than long, posterior two much longer than high. Temporals 1 | 2, all longer than high, anterior in contact with both postoculars.

Dorsal cross-bands two scales wide, four scales apart, with zig-zag outlines from never crossing a scale. Posteriorly their extremities are broken off into a lateral series of spots. Belly with a series of elongate blotches on each side, which alternate with the lateral spots; dusted with brown medially. Top of head dark brown, with five darker light-edged spots; one on the junction of prefrontals with frontal, on one outer posterior angle of latter, and one on each occipital plate. Labial plates all reddish-brown margined.

Gastrosteges 165; anal 1; urosteges 74. Total length 16 in.; of tail 3·75 in.; of gape 5 l.

From Bahia, Brazil. Spec. in Mus. Academy, presented by E. D. Cope.

LEPTOGNATHUS VAGA Jan., Elenco Systematico (nondescripta).

This species has not been described, so far as the writer is aware, but it can be assigned to its place in consequence of an examination of the original specimen, which was permitted the writer through the attention of Prof. Jan.

It belongs to group II, and has but two postocular plates; of its preoculars nothing can be said. Superior labials eight. There are four pairs of genials. General form less compressed than the types, with rather short body and tail. Above wood-brown, with indistinct cross series of spots. Below yellowish, tesellated with brown. Size not large for the genus.

This species is said to have been brought from Hong Kong, but this is altogether improbable; it is probably South American.

Another species, *L. incertus*, from Surinam, is named but not described by Jan, and is therefore likely to remain *incertus*.

LEPTOGNATHUS BREVIS Dum. Bibr., vii, 476.

This species is not described in sufficient detail to allow me to refer it to its place in this genus. It appears, however, to be different from any species here enumerated, though it has the coloration of several Mexican species.

Mexico, Dum. Bibron.

LEPTOGNATHUS OREAS Cope. See preceding Catalogue.

LEPTOGNATHUS INÆQUIFASCIATA Cope. *Cochliophagus inæqui.* Dum. Bibr., vii.

From Brazil, with doubt. D. B.

LEPTOGNATHUS NEBULATA Günther, Linn. *Petalognathus* Dum. Bibr. *Coluber variegatus* Hallowell, Pr. A. N. S. ii, 214. See Catalogue.

LEPTOGNATHUS ANTHRACOPS Cope, sp. nov.

A strongly marked species, having a general resemblance to the L. sartorii.

Muzzle short, narrowed, frontal plate longer than wide, with straight sides; occipitals not shortened, broadly rounded behind. Anterior three labials narrow and high. fourth and fifth only touching orbit. Sixth upper labial much higher than long; seventh much longer than high. Inferior postocular larger than superior. Temporals rather small, subequal, 1 | 2 | 3; loreal longer than high. Sixth inferior labial enlarged. Second pair genials longer than wide, third pair wider than long.

Yellow annuli, $9\frac{1}{2}$ rows scales apart anteriorly, four rows distant posteriorly; yellow rings, wider behind. There are twenty-three on the body, twelve on the tail. They are often alternating on the belly, which is otherwise unspotted. No white markings on top of head.

Gastrosteges 177; anal 1; urosteges 76, some dozen or more at the tip of the tail undivided in the individual at hand.

Total length 19 in. 8 l.; of tail 5 in. 3 l.; of gape 4·75 l.

From Central America; one sp. in Mus. Academy from E. D. Cope, procured from the traveller and collector, Robert Bridges.

LEPTOGNATHUS BREVIFACIES Cope. *Tropidodipsas brevifacies* Cope, Proc. A. N. Sci. Philada. 1866.

From Yucatan.

LEPTOGNATHUS TURGIDA Cope, sp. nov. "*Cochliophagus inæquifasciatus* D. B.," Cope, Proc. A. N. Sci. Philada. 1862, 347; not of Dum. Bibr.

This species has the head very little distinct from the body when viewed from above, and the neck but little compressed. In profile the frontal region is seen to be concave, and the top of the muzzle swollen both longitudinally and transversely. The internasals are but little broader than long; the same may be said of the large prefrontals. Frontal hexagonal, scarcely longer than broad, with strongly convergent sides. Occipitals narrowed, emarginate behind. Temporals 1 | 2 | 2, the anterior not large, in contact with both postoculars and fifth and sixth upper labials. Seventh labial bounded by two. The five anterior labials are higher than long, the two others a little longer than high, third and fourth entering orbit. Loreal longer than high. Eight inferior labials, fifth with greater transverse than longitudinal diameter.

Gastrosteges 159; anal 1; urosteges 41.

Color above a rich yellow-brown, with a series of black spots on the dorsal region, which are longer anteriorly, but separated by nearly equal spaces of 1·5 to 2 scales; length of third spot 7·5, scales of tenth, three scales. Behind the third spot the lateral portions are separated and sometimes divided, and extend to the ends of the scuta. Below nearly unspotted, except on tail. Gular region also immaculate. Head above thickly dusted with brown, paler on nape and top of muzzle. A pair of deep brown, yellow-edged spots on each occipital plate, converging behind; labials brown-dusted.

This is one of the most handsomely colored of the species, and of aberrant form.

From the Northern part of the Paraguay river.

Leptognathus fasciata Cope. *Tropidodipsas fasciata* Günther, Catal. Snakes Brit. Mus., 1858.

From Mexico.

Leptognathus sartorii Cope. *Tropidodipsas* do. Cope, Proc. Acad. Nat. Sci. 1863, 100.

Vera Cruz, Mexico.

BATRACHIA.

Prostherapis inguinalis Cope, genus et species novæ Colostethidarum.

Char. gener.—Xiphisternum membranous (difficult to discover), manubrium a bony style, with cartilage disc; metatarsus slightly webbed, dilatations strong, each with two dermal scales on the upper side, separated by a fissure; terminal phalanges small, T-shaped; tongue cylindric, free; no vomerine teeth; belly not areolate. Pupils longitudinal. Ethmoid well developed anteriorly, the prefrontals lateral, well separated.

This genus is interesting, as constituting the second of the little known family of the Colostethidæ, which was established by the writer in 1867. Its general appearance is that of a Phyllobates, and it is related to Colostethus much as Limnocharis is to the first-named. The two leathery scales of the pallettes are peculiar, and resemble those of the under side in Phyllodactylus. The distal phalanges are short, and extend very little into the dilatation.

Char. specif.—Muzzle and canthus rostralis angulated, the former projecting, rounded, truncate from above; the loreal region nearly vertical. Nostril nearly terminal, eye large, its long diameter equal to near end of muzzle. Membrana tympani concealed. Skin everywhere smooth, a weak fold on the distal half the tarsus. Free portions of the metatarsi only webbed, all the toes with strong dermal margin; the fingers with a weaker one. Digital dilatations extended rather transversely; two metatarsal tubercles, both small, inner elongate. Inner nares almost lateral, ostia pharyngea small, half the size of the former.

Width head and jaws one-third length to end coccyx, and equal length head to opposite usual position of posterior margin tympanum. Heel to middle of orbit, wrist to beyond end muzzle.

	Lin.
Length head and body	12·5
" fore limb	8
" hind limb	18·5
" foot without tarsus	5·6

Color dark brownish-leaden, below dirty white. The almost black of the sides bounded below by an irregular pale border, below which are some dark marblings. The same border extends, with an axillary interruption, to the orbit, and continues on the upper lip as a series of light dots. A light band commences at the groin above, and extends to opposite the sacrum, converting the dark color of the side into a half band. Femur and tibia dark, marbled before and behind.

From the river Truando, New Grenada. Brought by the expedition under Lieut. Michler, by Arthur Schott. This species and the Dendrobates tinctorius Wagl. were accidentally omitted from the report of this expedition, published in Proc. Acad. 1862, 355.

BUFO ARGILLACEUS Cope, sp. nov.

Ridges of cranium superciliary and supratympanic; no parietal branch. Parotoids elongate trigonal, the long angle prolonged towards the sides. Two weak metatarsal tubercles. A tarsal dermal fold; toes little webbed. Muzzle elongate, not much depressed or projecting beyond labial border. No preorbital ridge; superciliaries nearly parallel. Skin rather finely rugose.

Males olive-grey; females with a pale vertebral line, and a series of brown spots on each side of it. Crown, lips, and below unspotted. Length of head and body 2 in. 9 l.

This species is to be compared with the B. granulosus of Spix, which it represents in another region. It differs in lacking the preorbital ridge, and having a longer muzzle.

Numerous specimens in Museum Smithsonian from Colima, Western Mexico, from U. S. Consul, John Xantus.

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Second Supplement on some New Raniformia of the Old World.

TOMOPTERNA LABROSA Cope, sp. nov.

Head raniform, little elevated; end of muzzle recurved, loreal and suborbital regions concave, the edge of the maxillary region strongly projecting. From orbit to margin of jaw below it less than diameter of tympanum, two-thirds that of orbit. Tympanum elliptic, subvertical, about ·66 long diameter eye fissure, latter ·2 greater than from edge of same to external nostril, and 1·5 least interorbital width. Frontal and prefrontal regions slightly grooved medially. Vomerine teeth in two very short, nearly transverse, lines opposite the middle margin of the inner nares. Latter large, about equal to ostia pharyngea.

When the limbs are extended the carpus attains the end of the muzzle, and the heel the middle of the orbit. Tarsus equal third toe without last two phalanges. Cuneiform shovel small for the genus, equal inner toe less the last phalange. Webs large, measuring ·66 the third and fifth toes. Thumb longer than second and fourth fingers. Skin of upper surfaces with numerous narrow irregular folds; eyelids slightly rugose behind. A strong fold above the tympanum decurved behind it.

	In.	Lin.		In.	Lin.
Total length head and body...	2	4·5	Length tarsus........................		6·
" " hind limb.........	3	4·5	" foot........................	1	
Length tibia........................		·13	Width head behind.............	1	

Color above gray-olive, with paired blackish spots, on each side a light vertebral band. The anterior of these are a triangular blotch on top of muzzle and band across middle of each eyelid. Side of head blackish-gray with a pale gray band on end of muzzle, one from front of orbit to lip, and one below eye, longitudinally past lower edge tympanum bordered by blackish from orbit backwards. Femur with three, tibia with four, and outer edge foot with four blackish-gray cross-bars; femur pale-brown behind.

This species is more slender in form than the others of the genus, and exhibits a fuller palmation of the feet; it does not differ more from the species of Hoplobatrachus Pet. than the Ranæ do among themselves. One spec. (282) has the whole upper surface of the head, and a broad vertebral band yellow. Of the types are two specimens (No. 283) in Museum Comparative Zoology, Cambridge, all from Madagascar, presented to Prof. Agassiz by G W. Goodhue.

TOMOPTERNA POROSA Cope, sp. nov.

Toes nearly completely webbed, 2·3 phalanges of the fourth toe free. Muzzle obtuse ovate from above, decurved in profile, as long as diameter of eye-slit. Top of front and muzzle plane, canthus distinct, contracted, obtuse loreal region with a longitudinal concavity. Tympanum round, nearly as large as eye, distinct From orbit to maxillary border ·66 diameter tympanum; lip rather prominent below orbit. Vomerine teeth in two fasciculi opposite middle or hind margin of choanæ, nearer each other than margin. Choanæ smaller than the large ostia.

Fingers with very small web at base, thumb longer than second, equal fourth. Tarsus of extended limb beyond end muzzle; heel to front of orbit. Tarsus 2·3 times in longest toe. Cuneiform shovel 2·66 times in tarsus.

	In.	Lin.		In.	Lin.
Length head and body	2	1·75	Length head to tympanum behind..........................		8·25
Hind limb	3	3 75			
Tibia................................		·11	Width head same point........		9·
Hind foot..........................	1	·7			

A glandular dermal fold from above tympanum to above groin on each side; the greater part of the eyelid glandular and covered with pores. A glandular fold from angle mouth to behind above axilla. No tarsal folds.

Color above brown, with dark-gray shades; in one specimen an imperfect pale-gray vertebral line. Under surfaces white, sides coarsely and handsomely marbled with brown and white below and gray above. Head dark-brown, a pale line on the lip, a slight margin to lower lip. Femur brown with pale marblings.

This species is abundantly different from those hitherto known, and seems to indicate that the genus Hoplobatrachus Peters is less distinct from Tomopterna than hitherto supposed.

Three specimens (No. 305), Agassiz' Mus. Compar. Zoology, Cambridge, Mass. From Kanagawa, Japan. From Dr. Jas. T. Gulick.

HYLORANA LEPTOGLOSSA Cope, sp. nov.

This species is most nearly allied to the H. temporalis Günther of Ceylon. The points of difference are *italicised* in the following description:

Hind limbs as in H. temporalis, and the fourth toe is only ·33 longer than the third and fifth. Two well marked metatarsal tubercles. Vomerine teeth in two very short oblique rows commencing opposite the posterior margins of the choanæ and directed backwards; they are about as far from each other as from choanæ. *Tongue narrow, not filling rami of jaws.* Tympanum as large as eye; *latter contained* 1·5 *times in length of muzzle*, extending beyond nostril. A heavy glandular dorsolateral fold, *separated by a groove from another interrupted one below it.* A deep groove from axilla to near groin. *A short glandular fold from angle of mouth. Muzzle flattened acuminate at the end.* Heel of hind limb to front of orbit. Fourth toe more than half length head and body; *no dermal fold on upper edge of tarsus.*

Above olivaceous, with a blackish band from end muzzle *to groin*, margined with yellow below, from below eye to axilla. Pale yellow below, sides blackish spotted. Femora behind black, yellow veined. Limbs paler, rather closely cross-barred.

	Lin.		Lin.
Length head and body...............	21·5	Width head behind tympanum..	7.75
" hind limb	20·	Length hind foot	14·5

Three specimens (623) in Mus. Compar. Zoology, Cambridge, Mass. From near Rangoon, Burmah. With many other valuable specimens, these were procured by Wm. Theobald, Jr.

HYLORANA SUBCŒRULEA Cope, sp. nov.

Fourth toe somewhat more than half the length of the head and body. Two lateral glandular folds, the inferior much narrower, not reaching groin from angle mouth. No groove on the side of the belly. General form slender, the head elongate, the muzzle produced, 1·5 length of eye fissure, the nostril measuring two-fifths this distance. Tympanum ·66 the diameter of eye. Interorbital width equal from eye to nostril. The middle of the metacarpus measures the end of the muzzle, as does the proximal two-fifths the tarsus. Skin above smooth except on posterior iliac region, where are small warts. Sides scarcely glandular. A delicate fold on tarsus; one metatarsal tubercle. Tongue rhombic, filling space between rami, contracted a little behind. Vomerine teeth in two rather long series originating at the front of the choanæ, and extend very obliquely backwards, and well separated. 1·3 phalanges of third and fifth toes free, and three phalanges of fourth toe.

Above glossy blue, sides with a blackish-blue band from end muzzle to groin. Dermal folds and a band all around the upper lip brassy yellow. Femora behind speckled and marbled with yellow on a blackish ground, and with a dark longitudinal band below; upper face tibia golden brown, not cross-barred. Arm not crossed-barred. Everywhere below brown shaded, palest on the belly. In a younger specimen the belly is white and the upper surfaces pale brown.

	Lin.		Lin.
Length head and body	15·1	Length hind limb	2.8
" tibia	8·	" to behind tympanum	6·
" tarsus	4·5	Width at same point	4·5
" foot	8·25		

This very handsome animal is nearest in general characters to the H. macrodactyla Günther, a specimen of which was procured at the same locality, viz.: Rangoon, Burmah, by Wm. Theobald, Jr., above recorded. Its feet are much less palmate than those of the H. chalconota, from Java, which it also resembles. It is one of the best illustrations of a genus which has been particularly furnished among the Batrachia with beauty of hue and lustre. Mus. Compar. Zoology (624—626), three specimens.

Sexual Law in ACER DASYCARPUM Ehrb.

BY THOMAS MEEHAN.

Noticing among the silver maple trees at Bristol, Pa., some trees which had evidently borne only pistillate flowers for many years, and had subsequently pushed forth branches which bore only male flowers, it occurred to me that possibly extended observations might enable me to discover the law which governed the production of male or female forms respectively. I afterwards examined carefully some thousands of trees in blossom, and though I failed in the immediate object, the discovery of the law, it may serve an useful purpose to place on record the facts observed in the investigation.

The staminate flowers are easily distinguished from the pistillate ones, not only by their larger size, owing to the development of the stamens, but by the pale yellowish-green of the filaments. The awl-shaped styles of the female flowers do not project far beyond the scales, and are reddish-brown. The Bristol trees were about a foot in diameter, very healthy, judging by their clean smooth bark, and had probably been in fruit-bearing condition for at least ten years. The proportion of male to female trees was about equal. There were many instances of branches with male flowers which had perhaps within the last three or four years pushed out on trees which had evidently once borne only female ones; but in no instance did a female branch start out from a male tree. Having once began to bear male flowers, these branches continued to develop these only, presenting the appearance of another variety grafted on another stock.

Returning to Philadelphia, noting every tree I met on the side walks, I saw a very few trees which had male and female flowers scattered promiscuously over the same branches. These are very rare; but the fact of their existence may have an important bearing on any attempt to evolve the laws governing the production of separate sexes.

At Germantown I chose for the field of my investigation the large estate of Mrs. G. W. Carpenter, on which are many hundreds about twenty-five to thirty years old; but amongst all these I did not note one which showed any tendency to branch into distinct sexes like those at Bristol, or any one with mixed sexes like the few seen in Philadelphia. All the trees were either exclusively male, or exclusively female.

The parts of fructification in *Acer dasycarpum* have not, to my knowledge, been minutely described. It will be of interest, in connection with the subject of this paper, to note them.

There are three classes of buds on the tree: leaf-bearing, staminate. and pistillate. The leaf-bearing buds are formed of eight imbricated scales in four pairs, the scales all distinct and beneath the uppermost pair; five embryo leaves, rolled up to look very much like imperfect anthers, form a sort of crown. The bud bearing the staminate flower, or rather which forms it, has also eight scales, the upper two uniting for nearly half their length, and recurved at their summits when the flower is fully formed, making a cup-like involucre, at the bottom of which arise five (rarely seven) corollas, which are separated from each other at their bases by a fuscous down. These corollas are about one-fourth of an inch long, the lower half tubular, the upper half funnel-shaped, the five (rarely seven) stamens arising from the base of the funnel. The filaments are double the length of the corolla, which we may properly term it.

The female flower primarily resembles the other two in this, that it is composed of eight scales imbricated in pairs; but what in the male we call a corolla is reduced to a pair of united scales not more than one-thirty-second of an inch in depth, united into a flattened cup, with the edges rather inclined than to turn out. In the center is the two-styled ovary, and at its base arise seven stamens, although sometimes only four, generally five, push their anthers above the minute scaly cup outside. These anthers appear large and well-developed, but I have failed to find pollen in any one, and in no instance have I been able to find a perfect stamen like unto those formed in the staminate flower. These rudimentary stamens never push beyond the scales. Though classed as a Polygamous species by authors, it would appear from these observations a monœciously Diœcious plant.

In trying to classify my observations, in order to evolve some sexual law, I found that vigor made no difference; weak trees or weak branches were alike male or female Some individuals are more years coming into flower than others. I fancied I had once got a clue in the fact that in the commencement of my observations I found numerous specimens of great size which were apparently commencing their fruiting age, and which were female trees in all cases; but at length I discovered two trees of the same character of the masculine kind.

The only positive fact in relation to the matter seems to be that the sexual character of the maple is not unchangable after the infancy of the tree; and that the tendency of development is from female to male.

April 7th.

Isaac Lea, LL.D., in the Chair.

Thirty-one members present.

The following was presented for publication: "Description of Sixteen new species of Unio of the United States." By Isaac Lea.

April 14th.

Mr. Vaux, Vice President, in the Chair.

Twenty-nine members present.

April 21st.

Mr. Vaux, Vice-President, in the Chair.

Twenty-four members present.

The following was presented for publication:

"Notes on some singular species of Unio." By Isaac Lea.

A letter from Mr. A. R. Roessler, dated Washington, April 18, was read, stating that he had examined a specimen of tin stone, from the vicinity of Ironton, Mo., and had found it to contain a "very favorable percentage of metal."

Dr. Genth remarked that he had examined specimens of the best tin ore of Missouri, and found that they contained only six pounds of tin to the ton of ore.

April 28th.

Mr. Jos. Jeanes in the Chair.

Forty-three members present.

The resignation of Mr. Samuel Jeanes, as a member of the Academy, was read and accepted.

The death of Mr. Isaac Barton was announced.

The following gentlemen were elected members: Dr. H. C. Chapman, Mr. Charles Wilson Peale, Mr. Benj. Bullock, Mr. Thos. Webster, and Dr. E. Dyer.

Dr. T. H. Turner, U.S.A., was elected a correspondent.

On favorable report of the committees, the following papers were ordered to be published:

On a New MINERAL in CRYOLITE.

BY THEO. D. RAND.

This mineral, for which I propose the name Ivigtite, from its locality, was first observed in 1866, but only recently has been obtained in sufficient quantity for examination.

It occurs disseminated in films and seams through massive cryolite—sometimes forming a coating between crystals of carbonate of iron and the cryolite in which the carbonate is imbedded. Color pale yellowish-green, sometimes yellow. Structure fine granular, approaching micaceous. Hardness 2—2·5 S. G. 2·05. B. B. alone blackens slightly and fuses rather easily to a white slag. With carb. soda fuses readily and with effervescence to a greenish bead. In borax dissolves readily iron reaction. In microcosmic salt dissolves readily, except silica skeleton, bead yellow while hot, bluish opalescent when cold. In closed tube yields acid water.

With considerable difficulty 0·679 gm. of the mineral, free from admixture, was obtained and submitted to analysis with the following percentage result:

Water	3·42
Fluorine	·75
Silica	36·49
Sesquioxide of iron	7·54
Alumina	24·09
Soda	16·03
Loss	11·68
	100·00

The very small quantity of the mineral which could be procured prevented a more satisfactory result, but from the foregoing characteristics I feel justified in pronouncing it a new species, and hope that a larger quantity may be procured and a correct analysis made.

Pachnolite, besides its usual occurrence in honey-combed cryolite, nearly or always in juxtaposition with the so-called Hagemannite, has been observed in crystals implanted on massive cryolite, and also coating crystals of the latter, mixed with microscopic crystals of cryolite. The crystals of pachnolite are always small, rarely exceeding the fiftieth of an inch in diameter, but those of cryolite have been found measuring over 3-10ths of an inch cube. The crystals of carbonate of iron, found in the cryolite, have probably never been excelled for size and beauty. They are usually simple rhombohedrons, often of fine polish and measuring from half an inch to four inches across. A black blende, containing much iron, has been found in the massive cryolite, crystallized in perfect octahedra.

Philadelphia, March 23, 1868.

Description of Sixteen New Species of the Genus UNIO of the United States.

BY ISAAC LEA.

UNIO MURRAYENSIS.—Testa lævi, obliqua, tumida, solida, valde inæquilaterali, postice rotundata, antice truncata; valvulis crassis, antice crassioribus; natibus valde elevatis, tumidis; epidermide luteo-fuscata, concentrico-vittata, eradiata; dentibus cardinalibus crassis, subelevatis; lateralibus crassis, obliquis rectisque; margarita argentea et iridescente.

Hab.—Murray County, Georgia, Maj. T. C. Downie; Etowah River, Georgia. Bishop Elliott.

UNIO FASSINANS.—Testa lævi, elliptica, subcompressa, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus; epidermide tenebroso-rufo-fusca, eradiata; dentibus cardinalibus crassiusculis, compressis, obliquis; lateralibus sublongis, crassis, obliquis corrugatisque; margarita salmonis colore tincta, splendida et iridescente.

Hab.—Headwaters of Holston River, Washington Co., Va., Prof. E. D. Cope.

UNIO SPARUS.—Testa lævi, lato-elliptica, subinflata, valde inæquilaterali, postice obtuse angulata, antice rotundata; valvulis subtenuibus, antice crassioribus; natibus prominulis, ad apices minute undulatis; epidermide subcrocea, valde radiata; dentibus cardinalibus parvis, erectis, conicis; lateralibus longis subcurvisque; margarita salmonis colore tincta et valde iridescente.

Hab.—Swamp Creek, North Georgia, Maj. T. C. Downie.

Unio Copei.—Testa lævi, elliptica, subcompressa, inæquilaterali, antice et postice rotundata; valvulis subcrassis antice crassioribus; natibus prominulis, ad apices undulatis; epidermide tenebroso-fuscata, ad marginem squamosa, eradiata; dentibus cardinalibus subcrassis, elevatis, compressis, corrugatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis, subcurvatisque; margarita purpurea et valde iridescente.

Hab.—Headwaters of Holston River, Smith Co., Va., Prof. E. D. Cope.

Unio cylindrellus.—Testa lævi, late elliptica, cylindracea, valde inæquilaterali, antice et postice rotundata; valvulis subcrassis, antice crassioribus; natibus prominulis; epidermide luteola, eradiata; dentibus cardinalibus parvis, subconicis corrugatisque; lateralibus longis subrectisque; margarita intus purpurea et valde iridescente.

Hab.—Duck Creek, Tenn.: Swamp Creek, Murray Co., Ga., Major Downie; and North Alabama, Prof Tuomey.

Unio difficilis.—Testa lævi, elliptica, inflata, valde inæquilaterali, postice obtuse angulata, antice rotundata; valvulis tenuibis, antice crassioribus; natibus prominulis; epidermide luteola, valde radiata; dentibus cardinalibus parviusculis, conicis crenulatisque; lateralibus sublongis rectisque; margarita alba et valde iridescente.

Hab.—Swamp Creek, Ga., Major Downie; Holston River, Washington Co., Prof. Cope.

Unio Topekaensis.—Testa lævi, lata, subcompressa, valde inæquilaterali, postice obtuse angulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus prominulis, ad apices undulatis; epidermide tenebroso-fusca, radiata; dentibus cardinalibus erectis, compressis crenulatisque; lateralibus longis rectisque; margarita cæruleo-alba et valde iridescente.

Hab.—Topeka, Kansas, Prof. Daniels; Little Arkansas, Dr. Le Conte, &c.

Unio Brazosensis.—Testa plicata, subrotunda, ventricosa, valde inæquilaterali, antice et postice rotundata; valvulis percrassis, antice crassioribus; natibus prominentibus, tumidis, incurvis, ad apices minute undulatis; epidermide tenebroso-rufo-fusca, eradiata; dentibus cardinalibus percrassis, solidis, erectis corrugatisque; lateralibus longis, subcrassis et obliquis; margarita argentea et valde iridescente.

Hab.—Dallas Co., Texas, Prof. Forshey; Brazos River, Dr. Lincecum.

Unio Lincecumii.—Testa plicata, rotundata, subglobosa, valde inæquilaterali; valvulis precrassis, antice crassioribus; natibus prominentibus, tumidis, incurvis, ad apices minute undulatis; epidermide tenebroso-fusca, nigricante, eradiata; dentibus cardinalibus percrassis, solidis, erectis corrugatisque; lateralibus longis, subcrassis et obliquis; margarita argentea et valde iridescente.

Hab—Dallas County, Texas, Prof. Forshey; Brazos River, Texas, Dr. G. Lincecum.

Unio corvinus.—Testa lævi, elliptica, inflata, valde inæquilaterali; antice et postice rotundata; valvulis subcrassis, antice crassioribus; natibus vix prominentibus, epidermide nigra, subsquamea, eradiata; dentibus cardinalibus parvissimis decussatisque; lateralibus longis subrectisque; margarita alba et valde iridescente.

Hab.—Flint River, Geo., J. C. Plant and Dr. Neisler; Neuse River, N. C., Prof. Emmons.

Unio corvunculus.—Testa lævi, elliptica, subinflata, valde inæquilaterali; antice et postice rotundata; valvulis crassiusculis, antice crassioribus; natibus prominulis, ad apices subconcentrico-undulatis; epidermide nigricante, eradiata; dentibus cardinalibus parvis, erectis, subcompressis crenulatisque; margarita purpurea et iridescente.

Hab.—Flint River, Ga., J. C. Plant and Dr. Neisler; Darien, J. H. Couper.

Unio planior.—Testa subsulcata, subtriangulari, ad latere planulata, inæquilaterali; valvulis crassiusculis, antice crassioribus; natibus subprominentibus; epidermide vel lutea vel ochracea, radiata; dentibus cardinalibus parvis, compressis striatisque; lateralibus longis, crassiusculis et obliquis; margarita alba et iridescente.

Hab.—Tennessee, Mr. H. Moores; Headwaters Holston River, Washington Co., Virginia, Prof. Cope.

Unio vallatus.—Testa nodulosa, rotundata, lenticulari, subinflata, inæquilaterali; valvulis, crassis, antice crassioribus; natibus subprominentibus; epidermide luteo-fusca, eradiata; dentibus cardinalibus pergrandibus, elevatis granulatisque; lateralibus crassis, curtis obliquisque; margarita argentea et iridescente.

Hab.—Alabama River, Dr. Showalter.

Unio refulgens.—Testa nodulosa, rotundata, lenticulari, inæquilaterali; valvulis subcrassis, antice crassioribus; natibus prominulis; epidermide rufo-castanea, aliquanto polita; dentibus cardinalibus subgrandibus, eleganter corrugatis crenulatisque; lateralibus longiusculis, obliquis, minute corrugatis; margarita albida, ad marginem purpurescente et elegantissime iridescente.

Hab.—Oktibbeha River, Lauderdale Co., Miss., W. Spillman, M. D.

Unio Uharéensis.—Testa lævi, oblonga, ad latere planulata, inæquilaterali, postice biangulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus prominulis; epidermide rufo-fusca, subsquamea, eradiata; dentibus cardinalibus parvis, striatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis subcurvisque; margarita vel alba vel salmonis colore tincta.

Hab.—Uharee River, Montgomery Co., N. C., F. A. Genth, M. D.

Unio sphæricus.—Testa nodulosa, valde inflata, subglobosa, fere æquilaterali; valvulis crassis, antice crassioribus; natibus elevatis; epidermide rufo-castanea, eradiata; dentibus cardinalibus pergrandibus, corrugatis crenulatisque; lateralibus curtis, crassis, corrugatis, obliquis subcurvisque; margarita argentea et valde iridescente.

Hab.—Pearl River, at Jackson, Miss., C. M. Wheatley.

Notes on some singular forms of Chinese species of UNIO.

BY ISAAC LEA.

In a paper on "Chinese Shells," by Dr. Baird and Mr. H. Adams, published in the Proceedings of the Zoological Society of London, May 9, 1867, there are some remarks and claims which call upon me for correction.

1st, "*Unio Douglasiæ.*" It is stated that "in 1833 Dr. Gray shortly described and accurately figured in the 12th volume of Griffith's edition of Cuvier a species of *Unio*, which he called *U. Douglasiæ*," &c. Further, that "Mr. Lea, some years afterwards, from not knowing the shell as figured in Griffith, described and figured a species from China, which he named *U. Murchisonianus*, but which there is no doubt is the same as *U. Douglasiæ* of Gray." In the above statements there are several to which I beg leave to demur. It is suggested by these gentlemen that "perhaps from not knowing the shell (*Douglasiæ*) as figured in Griffith," I had "described and figured *Murchisonianus*, which there is no doubt is the *Douglasiæ* of Gray." In answer to this I would ask how I could, when I read my paper on the 16th March, 1832, before the American Philosophical Society, know of a description in Griffith's Cuvier dated 1834? (not in 1833, as incorrectly cited). *Douglasiæ* therefore cannot have precedence "of some years," as claimed for it, but it must remain a synonym to *Murchisonianus*, where I placed it in my *Synopsis*, first, second, and third editions, since 1836.

As regards the claim in the same paragraph for *U. Shanghaiensis*, Lea, being also a synonym to *Douglasiæ*, I am constrained to differ in opinion. *Shanghaiensis* is not the same with *Douglasiæ*, as affirmed, but it is the same with *U. Osbeckii*, Philippi, the description of which I had not seen. "Conchylien, vol. 3d." Some years since I placed it as a synonym to *Osbeckii* in the manuscript copy of my Synopsis, 4th ed., preparing for the press.

2d. *Anodonta tenuis*, Gray,—also called *Unio tenuis*, Gray, in Griffith's Cuvier,—is considered to be, by Messrs. Baird and Adams, an *Anodonta*, and it is said to be little known. This shell does not belong to either of these genera. It is a true *Dipsas* of Leach, and if Dr. Gray had had a perfect specimen before him when describing *Anodonta tenuis*, he never would have placed it in that genus. The *Dipsasian* character was evidently obliterated by age in the specimen from which he made his diagnosis. The young specimens, and the mature perfect ones, always have the tooth (so to call it) of the genus *Dipsas*. I described this species in the Transactions of the American Philosophical Society, March 15, 1833, under the name of *Symphynota discoidea*, with a figure perfectly representing the characteristic tooth, which consists of a single raised, slightly curved line under the dorsal margin. In my "Synopsis," in the first edition in 1836, as well as in the second and third editions, I gave Dr. Gray's *tenuis* as a synonym to this shell, which I there placed in the genus *Dipsas*, where it properly belongs. It must therefore stand as *Dipsas discoidea*, Lea, with the synonym of *Anodonta tenuis*, Gray; my date being 1833, and Dr. Gray's 1834.

In this paper of Messrs. Baird and Adams, they have described a supposed new species from Shanghai, under the name of *Unio* (Lampsilis) *subtortus*. I previously published a description of a species which I believe will prove the same, under the name of *tortuosus*, in the Proc. Acad. Nat. Sci. April 18, 1865. Since then I have found in the "Journal de Conchiliologie," July, 1863,—which work for that year was not accessible to me,—that Messrs. Crosse and Debeaux had given a description and an excellent figure of a *Unio* of the same twisted character, under the name of *Tientsinensis*, which, if the figure be entirely correct, differs in the form of the posterior slope, and in the undulations of that part.

I may be permitted to express my surprise that neither the French nor the English authors should have observed the very remarkable character of these Chinese species, which were before them, in being *inequivalve!* The figure in the *Journal de Conchyliologie* seems to be very correctly delineated by the artist, having represented the *inequivalve* condition of the right and left valves.

Messrs. Baird and Adams refer to *Tientsinensis*, but consider it to differ in some respects from their *subtortus*, which I think very likely. If *Tientsinensis* prove to be the same as *tortuosus* and *contortus*, then the two last must be synonyms. If not, then there will be two species, viz.: *Tientsinensis*, Crosse and Debeaux, and *tortuosus* (nobis),—*contortus*, B. and A., being a synonym to *tortuosus*.

May 5th.

MR. VAUX, Vice-President, in the Chair.

Twenty-nine members present.

The following paper was presented for publication: "List of

Birds collected at Laredo, Texas, in 1866 and 1867." By Dr. H. B. Butcher.

May 12th.

MR. VAUX, Vice-President, in the Chair.

Thirty-six members present.

The following were presented for publication: "Description of Four new species of Exotic Unionidæ," and "Description of Twenty-six new species of Melanidæ of the United States." By Isaac Lea, LL.D.

"Monœcism in Luzula campestris," and "Variations in Epigea repens." By Thos. Meehan.

Prof. Edw. D. Cope defined the characters of a new genus of Cheloniidæ, which represented the modern marine turtles in the Cretaceous green sand of New Jersey. It differed in the considerably greater co-ossification of the disc and marginal bones posteriorly and anteriorly. The anterior rib is attached to one marginal in advance of that to which it is connected in Chelone. He called it OSTEOPYGIS, and exhibited a specimen of the type species—O. emarginatus Cope—of which about half the carapace and plastron were preserved, and which indicated an animal of about the size of the green turtle. It was presented to the Academy by Dr. Samuel Ashhurst.

Prof. Cope stated that he was more or less acquainted with four species of the genus: O. sopitus (Chelone Leidy), O. chelydrinus Cope, and O. repandus Cope, all of the same or larger size than the type.

May 19th.

MR. VAUX, Vice-President, in the Chair.

Twenty-nine members present.

Prof. Cope called attention of the Academy to the rarity of Ophidian remains, and to the fact that none had been discovered in North America up to the present time. He then exhibited two vertebræ of a serpent of or near the family of the Boas, from the green sand of Squankum, Monmouth Co., N. J., which had been discovered by Dr. Knieskern.

Peculiar interest attached to these specimens, from the fact that they came from a bed which has recently been stated, by Conrad, to be an equivalent of the older Eocene or London clay of the Thames valley. They confirm this identification exactly, since they belong to Owen's genus Palæophis, which is characteristic of those beds in England. They indicate a species intermediate between the two larger described by Prof. Owen, and of some fifteen feet in length. It was associated with remains of crocodiles, sting-rays and saw-fishes, and was named, from its geographical and geological location, PALAEOPHIS LITTORALIS Cope.

The type specimens belong to the Geological Survey of New Jersey, under Prof. George Cook, and were lent by him for description.

Dr. Hayden read a letter from Prof. Leo Lesquereux, identifying the fossil plants of the coal formation of the south-west, as follows:

"I was unwell when your boxes of fossil plants arrived, and was not able to examine the specimens before now.

"Most of the leaves, which are well preserved indeed, belong to a new species of *Ficus*. It resembles *Ficus lanceolatus*, Heer., a miocene species, but differs by leaves being broader, mostly rounded at base, and not *always* alternated to the petiole. The medial nerves and shorter pedicel are thicker. Some of the leaves, which are narrower and narrowed to the petiole, present the form and appearance of *Ficus lanceolatus*, but the specific difference is marked by the thick nerves and shorter petiole.

"Among these leaves there are two fragments of leaves of a *Cinnamomum*, referrable perhaps to *C. affine*, Lesqx.; a large leaf of *Platanus*, probably *P. aceroides?* Aug., whose borders are destroyed, and a *Populus* with round leaves—*Populus subrotundus*, Lesqx.—found also by Dr. Hayden at Rock Creek.

"Besides these species, the specimens show a number of fragments of a *Cyperus*. apparently a new species. The nervation is that of *Cyperus charanensis*, Heer., but the leaves, 1½ inches broad, are twice as broad as in the European species."

Dr. Hayden considered this as confirming his opinion that the lignite beds of that region were of tertiary age.

Dr. Le Conte said that the question of the geological age of that section must be solved by a consideration of the relative positions of the strata, rather than by comparison of the fossil plants found therein.

May 26th.

MR. CASSIN, Vice-President, in the Chair.

Thirty-nine members present.

The following gentlemen were elected members: Mr. Edward Lewis, Jas. Truman, M. D., Wm. Trueman, M. D., Mr. S. Fisher Corlies, Mr. T. W. Starr, Edw. Rhoads, M.D., T. H. Andrews, M.D., Herbert Norris, M. D., Mr. Jas. S. Gilliams, Mr. Charles Bullock, Mr. Edw. L. Huitt, Mr. I. Zentmayer, Mr. Aug. F. Müller, F. F. Maury, M.D., Horace Williams, M.D., Mr. Wm. H. Walmsley, Mr. T. L. Buckingham.

The following were elected correspondents: Mr. Augustus Fendler, of Allenton, Mo.; Hon. J. S. Wilson, of Washington, D.C.; Mr. A. R. Roesler, Washington, D. C.; Prof. John Tomes, F.R.S., of London.

On favorable reports of the committees, the following papers were ordered to be published:

List of BIRDS collected at Laredo, Texas, in 1866 and 1867.

BY H. B. BUTCHER, M. D.

The list of birds here given embraces the species collected by me at Laredo, Texas, on the Rio Grande river, while engaged as Acting Assistant Surgeon of the U. S. Army; and is presented as a contribution to the subject of the geographical distribution of the birds of North America. No new species but many quite rare species were procured. The most interesting result of my examinations at Laredo was the discovery in abundance of *Scardafella inca*, a species not previously obtained north of the Rio Grande.

The collections made were first sent to the Smithsonian Institution, and a series afterwards presented to this Academy. I am indebted to Prof. Baird for assistance in identifying the species.

A comparison of this list with that of the birds collected in Texas by Mr. Dresser will be found of interest.

Tinnunculus sparverius, *Vieill.* Nov., Jan. and Feb.
Accipiter fuscus, *Bonap.* Jan.
Buteo swainsoni, *Bonap.* July.
Buteo borealis, *Vieill.* Jan.
Polyborus Audubonii, *Cassin.* Jan.
Athene hypugæa, *Bonap.* Oct., Jan.
Bubo virginianus, *Bonap.* Oct.
Geococcyx californianus, *Baird.* May to Sept. Abundant.
Coccygus erythrophthalmus, *Bp.* June to Aug.
Picus scalaris, *Wagler.* June to Nov. Abundant.
Centurus flaviventris, *Sw.* June to Nov. Abundant.
Antrostomus nuttalli, *Cassin.* Sept., Feb.
Chordeiles texensis, *Lawr.* May to Sept.
Ceryle alcyon, *Boie.* Oct.
Tyrannus verticalis, *Say.* May.
Myiarchus crinitus, *Cab.* Aug. and Sept.
Myiarchus mexicanus, *Baird.* Aug.
Sayornis fuscus, *Baird.* Nov.
Sayornis sayus, *Baird.* Nov., Jan., Feb.
Contopus virens, *Cab.* May.
Empidonax pusillus, *Cab.* May.
Empidonax flaviventris, *Baird.* Aug.
Turdus migratorius, *Lin.* Jan.
Sialia sialis, *Baird.* Nov.
Sialia arctica, *Swains.* Feb.
Anthus ludovicianus, *Licht.* Nov., Dec.
Regulus calendula, *Licht.* Dec., Feb.
Geothlypis philadelphia, *Baird.* Sept.
Helminthophaga celata, *Baird.* Nov., Jan., Feb.
Dendroica æstiva, *Baird.* May, Aug., Sept.
Dendroica coronata, *Gray.* Dec., Jan.
Myiodioctes pusillus, *Bonap.* Sept.
Pyranga æstiva, *Vieill.* Aug.
Cotyle serripennis, *Boie.* May, June, March.
Ampelis cedrorum, *Baird.* March.
Collyrio excubitoroides, *Baird.* April and Sept. to Nov., Jan., Feb.
Vireo gilvus, *Bonap.* May.
Vireo belli, *Aud.* May, June, Aug.
Mimus polyglottus, *Boie.* April to Oct., Dec. to Feb.
Oreoscoptes montanus, *Baird.* April, May to Nov., Dec. to March. Abundant
Harporhynchus curvirostris, *Cassin.* April to Nov., Feb. Abundant.
Harporhynchus longirostris, *Cassin.* May, Nov., Jan.
Campylorhynchus brunneicapillus, *Gray.* May, June, Nov., Feb.
Salpinctes obsoletus, *Cab.* May, Nov., Oct., Dec., Feb.
Thryothorus bewickii, *Bonap.* Nov. to Feb.
Polioptila cærulea, *Sclat.* July, Aug., Oct.
Lophophanes atricristatus, *Cass.* Aug., Nov.
Paroides flaviceps, *Baird.* May to Sept., Jan., Feb. Abundant.
Eremophila cornuta, *Boie.* Nov., Dec.
Chrysomitris tristis, *Bonap.* Dec.
Plectrophanes maccownii, *Lawr.* Dec.
Chondestes grammaca, *Bonap.* April, Sept. to Nov. Abundant.
Zonotrichia leucophrys, *Sw.* April, Dec. to Feb.
Zonotrichia gambelii, *Gambel.* Jan.
Poospiza bilineata, *Sclat.* June to Oct. Abundant.
Melospiza heermanni, *Baird.* Jan.
Peucæa cassini, *Baird.* June.
Melospiza lincolnii, *Baird.* Dec.

Embernagra rufivirgata, *Lawr.* Nov.
Calamospiza bicolor, *Bonap.* Nov.
Euspiza americana, *Bonap.* Aug.
Guiraca cærulea, *Sw.* May, June, Oct.
Cyanospiza ciris. *Baird.* April to Aug. Abundant.
Pyrrhuloxia sinuata, *Bonap* April to Sept., Dec. to Feb. Abundant.
Cardinalis virginianus, *Bonap.* May to Aug., Nov., Dec. Abundant.
Pipilo chlorura, *Baird.* Dec., Jan.
Molothrus pecoris, *Sw.* April to July, Jan. Abundant.
Xanthocephalus icterocephalus. April, May.
Sturnella neglecta. *Aud.* Oct. and Nov. Abundant.
Sturnella magna, *Sw.* Dec.
Icterus cucullatus, *Sw.* June.
Icterus spurius, *Bonap.* June, Aug.
Icterus bullockii, *Bonap.* May to Aug. Abundant.
Scolecophagus cyanocephalus, *Sw.* Nov., Feb.
Quiscalus macroura, *Sw.* June.
Corvus cryptoleucus, *Couch.* Feb., March.
Zenaidura carolinensis, *Bonap.* April to July.
Scardafella inca, *Bonap.* May, Sept. to Nov., Dec., Feb., March. Abundant.
Ortyx texanus, *Lawr.* Oct., Nov., Dec.
Callipepla squamata, *Gray.* April to Nov., Feb. Abundant.
Grus canadensis, *Temm.* Jan.
Ardea herodias, *Linn.* Jan.
Nyctherodius violaceus, *Reich.* Sept.
Aegialitis vociferus, *Cass.* April, May, Aug., Sept.
Tringa wilsonii, *Nuttall.* Oct., Dec.
Ereunetes petrificatus, *Ill.*
Actiturus bartramius, *Bonap.* Aug.
Tringites rufescens, *Cab.*
Pelecanus fuscus, *Linn.* May.

Descriptions of four new species of Exotic UNIONIDÆ.

BY ISAAC LEA.

Anodonta Strebelii.—Testa lævi, elliptica, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis pertenuibus; natibus prominulis; epidermide tenebroso-viridi, radiis capillaris indutis; margarita cærulea et valde iridescente.

Hab.—Vera Cruz, Mexico; Dr. G. Strebel, per Smithsonian Institution.

Unio Veracruzensis.—Testa lævi, elliptica, subcompressa, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis tenuibus; natibus prominulis; epidermide tenebroso-fusca, radiata politaque; dentibus cardinalibus parvis, compressis, crenulatis, in utroque valvulo duplicibus; lateralibus longis, rectis lamellatisque; margarita cærulea et valde iridescente.

Hab.—Vera Cruz, Mexico; Dr. G. Strebel, per Smithsonian Institution.

Unio prunoides.—Testa lævi, elliptica, valde ventricosa, inæquilaterali, antice et postice rotundata; valvulis subcrassis, antice aliquanto crassioribus; natibus prominulis; epidermide tenebroso-fusca, eradiata; dentibus cardinalibus compressis, obliquis et valde crenulatis; lateralibus longis, lamellatis corrugatisque; margarita argentea.

Unio Chinensis.—Testa nodulosa, subelliptica, inflata, fere æquilaterali, postice obtuse angulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus, ad apices corrugatis; epidermide virido-lutea, radiis viridis undique indutis; dentibus cardinalibus erectis, compressis, striatis, crenulatis et in utroque valvulo subduplicibus; lateralibus sublongis subrectisque; margarita argentea et valde iridescente.

Descriptions of Twenty-six New Species of MELANIDÆ of the United States.

BY ISAAC LEA.

GONIOBASIS WHEATLEYI.—Testa striata, subfusiformi, subinflata, subcrassa, ochracea, vel vittata vel evittata; spira conoidea, ad apicem aliquanto plicata; suturis irregulariter impressis; anfractibus instar senis, fere planulatis; apertura subconstricta; ovata, intus ochracea; labro acuto, parum sinuoso; columella inflecta, reflexa et tortuosa.
Hab.—Coosa River, Alabama, Dr. Showalter.

GONIOBASIS SIMILIS.—Testa striata, subfusiformi, subtenui, luteo-cornea; spira brevi, ad apicem plicata; suturis impressis; anfractibus instar senis, vix convexis; apertura subgrandi, ovata, intus luteo-alba; labro acuto; columella inflecta et tortuosa.
Hab.—Connesauga Creek, Georgia, Major T. C. Downie.

GONIOBASIS SULCATA.—Testa striata, conica, subcrassa, mellea, evittata; spira obtusa; suturis irregulariter impressis; anfractibus instar septenis, planulatis, ad apicem plicatis; apertura parviuscula, rhomboidea, intus alba, labro acuto, sinuoso; columella inflecta, incrassato.
Hab.—Cahawba River, Alabama, Dr. Showalter.

GONIOBASIS ARATA.—Testa valde striata, conoidea, subtenui, cornea, vel vittata vel evittata; spira elevata; suturis impressis; anfractibus septenis, planulatis, ad apicem carinatis et plicatis; apertura parva, ovata, intus albida; labro aliquanto crenulato; columella inflecta, ad basim retrorsa.
Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

GONIOBASIS GESNERII.—Testa striata, fusiformi, tenui, tenebroso-oliva; spira subbrevi; suturis impressis; anfractibus instar septenis, planulatis; apertura grandi, late ovata, intus lugubri; labro acuto, parum sinuoso; columella purpurescente et valde contorta.
Hab.—Uchee River, Alabama, Mr. W. Gesner.

GONIOBASIS TENEBROSA.—Testa valde striata, subfusiformi, subcrassa, tenebrosa; spira brevi; suturis irregulariter impressis; anfractibus instar quinis, vix convexis; apertura grandi, ovata, intus tenebroso-purpurea; labro subcrenulato; columella inflecta et parum contorta.
Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

GONIOBASIS BIFASCIATA.—Testa plicata, aliquanto striata, subcrassa, luteola, bifasciata; spira obtusa, valde plicata; suturis irregulariter impressis; anfractibus instar senis, planulatis; apertura parviuscula, subrotunda, intus albida; labro acuto, parum sinuoso; columella albida et contorta.
Hab.—Jackson Co., Alabama, Dr. Spillman.

GONIOBASIS CLATHRATA.—Testa plicata et striata, pyramidata, tenui, dilute cornea, efasciata; spira exerta, acuminata; suturis impressis; anfractibus octonis, convexiusculis; apertura parviuscula, rhomboidea, intus vel albida vel purpurea; labro crenulato, subsinuoso; columella valde contorta.
Hab.—Jackson Co., Alabama, Dr. Spillman.

GONIOBASIS PULCHELLA.—Testa plicata, subturrita, subtenui, rufo-cornea, vittata; spira elevata; suturis irregulariter impressis; anfractibus instar novenis, convexiuscula; apertura parviuscula, ovata, intus albida; labro acuto; columella inflecta et tortuosa.
Hab.—North Alabama, Dr. Spillman.

GONIOBASIS LUTEOCELLA.—Testa plicata et striata, fusiformi, subcrassa, ochracea, vittata vel evittata; spira brevi; suturis irregulariter impressis; anfractibus quinis, convexiusculis; apertura grandi, ovata, intus luteo-alba; labro acuto; columella superne incrassata et valde contorta.
Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

Goniobasis Connesaugaensis.—Testa plicata, inferne striata, subfusiformi, subtenui, vel mellea vel ochracea vel tenebroso-fusca, nitida; spira conoidea; suturis impressis; anfractibus septenis, planulatis; apertura subconstricta, rhomboidea, intus luteola vel tenebroso-fusca; labro acuto; columella inflecta et tortuosa.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

Goniobasis contigua.—Testa lævi, subfusiformi, tenui, tenebroso-oliva, evittata; spira subelevata; suturis impressis; anfractibus instar quinis. convexiusculis; apertura grandi, subrhombica, intus albida; labro acuto, sinuoso; columella vix incrassata et valde contorta.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

Goniobasis Murrayensis.—Testa lævi, fusiformi, inflata, subtenui, tenebroso-cornea, evittata; spira conoidea, ad apicem plicata; suturis aliquanto impressis; anfractibus instar senis, subplanulatis; apertura magna, subrhomboidea, intus luteola; labro acuto, parum sinuoso; columella inflecta et tortuosa.

Hab.—Swamp Creek, Murray Co., Ga., Maj. T. C. Downie.

Goniobasis granatoides.—Testa granulata, inferne striata, subfusiformi, subtenui, cornea; spira conoidea, ad apicem plicata; suturis impressis; anfractibus instar senis, vix convexis; apertura subgrandi, ovata, intus luteo-alba; labro acuto; columella tortuosa.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

Goniobasis clavula.—Testa carinata, aliquanto plicata, tenui, tenebroso-castanea, efasciata; spira exerta, acuminata; suturis regulariter impressis; anfractibus instar octonis, planulatis; apertura parvissima, ovata, intus castanea; labro acuto; columella alba et contorta.

Hab.—Jackson Co., Alabama, Dr. Spillman.

Goniobasis cochliaris.—Testa carinata et striata, cylindracea, tenui, tenebroso-fusca, evittata; spira attenuata; suturis valde impressis; anfractibus instar novenis, ad apicem valde carinatis, inferne striatis; apertura parvissima, late elliptica, intus tenebroso; labro subcrenato; columella inflecta, ad basim incrassata.

Hab.—Shelby Co., Alabama, Maj. T. C. Downie.

Goniobasis venusta.—Testa subcarinata, conoidea, subtenui, mellea, evittata; spira elevata; suturis regulariter impressis; anfractibus planulatis, instar septenis; apertura parva, rhomboidea, intus albida; labro acuto; columella inflecta et valde contorta.

Hab.—Coosa River, Alabama, Dr. Showalter.

Goniobasis ornata.—Testa carinata, subturrita, tenui, olivacea, valde vitatta; spira elevata, superne plicata; suturis valde impressis; anfractibus septenis, planulatis; apertura parviuscula, subrhomboidea, intus vittata; labro acuto, aliquanto sinuoso; columella vix incrassata et valde contorta.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

Trypanostoma nuciforme.—Testa lævi, obtuse conica, inflata, crassiuscula, castanea; spira brevi, obtusa; suturis regulariter impressis; anfractibus instar quinis, convexiusculis; apertura magna, rhomboidea; labro acuto; expanso, sinuoso; columella inflecta et valde tortuosa.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

Trypanostoma castaneum.—Testa lævi, pyramidata, subtenui, castanea, obsolete fasciata; spira exerta, acuminata; suturis impressis; anfractibus instar novenis, planulatis; apertura parviuscula, rhomboidea, intus dilute purpurea; labro acuto, sigmoideo; columella parum incrassata et valde contorta.

Hab.—Coosa River, Alabama, Dr. Showalter.

Trypanostoma Wheatleyi.—Testa lævi, pyramidata, tenui, dilute rubiginosa, vel fasciata vel efasciata; spira exserta, acuminata; suturis regulariter impressis; anfractibus instar denis; planulatis, ad apicem carinatis; apertura parviuscula, rhomboidea, intus albida; labro acuto, sigmoideo; columella ad basim parum incrassata et valde contorta.

Hab.—Coosa River, Alabama, Dr. Showalter.

Trypanostoma terebrale.—Testa lævi, pyramidata, tenui, olivacea, vel vittata vel evittata; spira valde exserta; suturis valde impressis; anfractibus instar duodenis, planulatis, ad apicem carinatis; apertura parviuscula, rhomboidea, intus albida vel vittata; labro acuto, sinuoso; columella impressa et valde contorta.

Hab.—Jackson Co., Alabama, Dr. W. Spillman.

Lithasia purpurea.—Testa lævi, curta, subcylindracea, subcrassa, tenebroso-purpurea; spira brevissima; suturis valde impressis; anfractibus instar quinis, convexiusculis; apertura grandi, rhomboidea, intus saturale purpurea; labro acuto, vix sinuoso; columella impressa, superne incrassata.

Hab.—Cahawba River, at Centreville, Bibb Co., Ala., Dr. Showalter.

Lithasia curta.—Testa granulata, curta, solida, luteo-olivacea, plerumque bifasciata; spira brevi; suturis irregulariter impressis; anfractibus instar quinis, planulatis; apertura subgrandi, rhomboidea, intus albida; labro acuto, subsinuoso; columella inferne et superne incrassata.

Hab.—North Alabama, Prof. Tuomey and Dr. Spillman; Tuscumbia, B. Pybus.

Schizostoma Wheatleyi.—Testa striata, subfusiformi, subtenui, luteola, imperforata, vittata; spira obtuso-conoidea; suturis irregulariter impressis; anfractibus instar senis, vittatis, ultimo grandi; fissura obliqua brevique; apertura parviuscula, ovata, intus alba et vittata; labro subcrenulato; columella alba, incrassata et contorta.

Hab.—Coosa River, Dr. Showalter.

Anculosa Downiei.—Testa plicata et obsolete striata, subglobosa, crassa, tenebroso-oliva, maculata; spira vix prominulis, plicatis; suturis impressis; anfractibus vix ternis, ultimo grandi et ventricoso; apertura grandi, subrotunda, intus fusco-maculata; labro acuto; columella impressa et incrassata.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie; Coosa River, Alabama, Dr. Showalter.

Variations in EPIGÆA REPENS.

BY THOMAS MEEHAN.

There are yet many botanists who regard variations as accidents. They speak of a normal form as something essential; and departures from their idea of a type, they refer to external causes, independent of any inherent power of change in the plant itself. Hence, when a change of form occurs to them, it is usually referred to shade, to sunlight, to an unusual season, situation, or some geological peculiarity of the soil. Cultivation is denounced as interfering with botanical science; introducing and originating innumerable forms, defying the skill of the botanist to classify or arrange. My experience in plant culture, and as an observer of plants in a state of nature, leads to the conclusion that there is no greater power to vary in the one case than in the other; that there is as much variation in the perfectly wild plant, as in those under the best gardener's skill. To illustrate this I gathered a great number of specimens of *Antennaria plantaginifolia*, which, though I do not believe has a greater average power of variation than any other plant, affords a good example for the following reasons: The small seeds I believe require a clear surface of ground to vegetate, and young plants therefore never appear in a meadow or grassy place. In such positions plants only exist that had a footing in advance of the grass. They then propagate exclusively by runners. After being two or three years in this situation they form patches of one or several square feet each. Now it is not easy to appreciate a minute difference between one single specimen and another; but when a score or more of specimens of one are matched against a similar number of the other, the minutiæ make an aggregate which is readily estimated. So we shall find in the case of a two or three year old meadow, filled with this plant, that not only are *no two patches alike*, but that the eye convinces us of the fact on the first glance over the field. Plain as the differences thus presented were, I found, however, some difficulty in describing them in language; and besides being a diœcious plant there might be brought in the objection of intercrossing between allied species of this or neighboring genera, if not of the individuals of the opposite sexes themselves, to account for so many forms. I therefore chose *Epigæa*, as belonging to a natural order exclusively hermaphrodite; containing only one natural species; not very closely allied to any of the neighboring genera, *Andromeda*, *Clethra*, *Gaultheria*, &c.; none of which, at any rate, flower at the same time with it.

On the 19th of April I gathered specimens from sixteen different plants on the Wissahickon, without taking any pains to make any particular selection of varieties. The following descriptions show their variations:

1. Tube of the corolla half inch long, contracted in the middle; segments of the corolla broadly ovate, one-third the length of the tube, incurved, pure white. Scales of the calyx two-thirds the length of the tube, narrowly lanceolate, interior ones white and membranaceous with a crimson base.

2. Tube half inch, regularly cylindrical; segments half as long as the tube, triangularly ovate, light rose, incurved. Scales one-third the length of the tube, white, coriaceous.

3. Tube quarter inch, thick (one-eighth wide), cylindrical; segments rather longer than the tube, triangularly ovate, incurved, deep rosy pink. Scales three-fourths the length of the tube, rosy red, with white margins.

4. Tube nearly half inch, contracted at the summit; segments very short, scarcely one-sixteenth of an inch, forming nearly five ovate repand teeth, purplish white. Scales greenish white, simply acute.

5. Tube quarter inch long, one-eighth wide; segments lanceolate, erect, two-thirds as long as the tube, rosy purple. Scales brown, not margined, drawn out to a long fine point.

6. Tube quarter inch, cylindrical; segments oblong ovate, recurved, as long as the tube. One of the anthers slightly petaloid. Scales prolonged into almost an awn.

7. Tube much narrowed at the summit, quarter inch long; segments less than one-sixteenth of an inch long, pale purple. Scales greenish brown, very narrow.

8. Tube near half inch, contracted in the middle; segments quarter inch, linear lanceolate, bright rose. Scales half the length of the tube, broadly ovate, membranaceous, simply sharp pointed.

9. Tube half inch, cylindrical; segments quarter inch, of which there are but *three* broadly ovate, white.

10. Tube nearly three-quarters inch, cylindrical; segments quarter inch, narrowly ovate. Scales as long as the tube, linear lanceolate, pale green.

11. Tube less than quarter inch, and shorter than the luxuriant foliaceous, mucronate scales. Segments of the corolla two-thirds as long as the tube, broadly ovate, pure white.

12. Tube quarter inch, increasing slightly in width upwardly (funnel-shaped), one-eighth thick at the top of the tube; segments short, ovate, reflexed, light pink. Scales longer than the tube, green, white margined.

13. Tube quarter inch, much contracted in the middle; segments quarter

inch, broad ovate. Scales half the length of the tube, brown, with white margins.

14. Tube under half inch, thick, perfectly cylindrical; segments quarter inch, broad linear, and rounded at the apex, waxy white. Scales quarter inch long, brown, with membranaceous margins.

15. Tube full three-quarters inch, cylindrical; segments quarter inch, triangularly ovate, pale rose. Scales half inch, narrow and drawn out to an awn-like point.

16. Tube half inch, cylindrical. Scales less than one-sixteenth of an inch, broad ovate, green, and barely pointed.

On again examining No. 12, after making these notes, I was surprised to find no trace of stamens, but with the pistil perfect; and on examining the other specimens I found three out of the fifteen were pistillate also. Another remarkable fact was that all these pistils had the fine cleft stigmas strongly recurved, exposing a glutinous surface; while the hermaphrodite ones kept the apex of the pistils closed. The ovaries of the pistillate forms were also evidently better developed than those in the hermaphrodite condition, and the inference was that the plant was *practically diœcious.*

On the third of May I returned to the locality and found this hypothesis in all probability correct. The pistillate plants were in proportion about one-third that of the hermaphrodite, and could be readily distinguished after the flower had faded by the recurved stigmas above noted. All the plants that had shed their corollas were pistillate; the apparently hermaphrodite plants having their corollas dry on the receptacles from which it was not easy to separate them—the scales of the calyx and a part of the stem coming away with them. This is so well known a feature of impregnation in the development of a fruit, that I need not dwell much on the importance of this fact, as showing the fertility of the pistillate, and the sterility of the opposite form.

I engaged friends to furnish me specimens from other places. Dr. James Darrach finds them, as I have above described, in another locality on the Wissahickon. Miss Anderson sends me ten specimens from Edge Hill, Montgomery County, Pa., amongst which two are purely pistillate, the rest varying much as in the Wissahickon specimens. Mr. Isaac Burk finds pistillate plants abound at Mount Ephraim, New Jersey, but there are abortive filaments without anthers, and he sends me one specimen of this character. Mr. Charles E. Smith sends me a dozen or so specimens from Haddonfield, hermaphrodite, and so exactly alike that they probably all come from one plant. Mr. E. Diffenbaugh sends ten specimens from another place in New Jersey, all with anthers, but varying from nearly no filaments to filaments three-eighths of an inch long; varying also in the proportionate lengths of scales, tubes and segments; but not near as much as in the Wissahickon specimens. Prof. Cope sends samples from Delaware County, Pa. These are varied like the Wissahickon ones; and Mr. Cope remarks to me that the pistillate forms are so distinctly characterized, by the vasiform recurved corollas and other characters, that he can readily distinguish them as he walks along.

Has this peculiarity of *Epigæa repens* been overlooked by the many botanists who must have critically examined it heretofore? Or has the plant reached a stage of development when germs of new forms spring actively into life?

In a paper on *Lopezia*, published in the last volume of the Proceedings, I showed that the sexual organs of that genus were admirably arranged to prevent the pollen of a flower falling on its own stigma. This behavior of *Epigæa* adds another to the list of plants, now so extensive, known to have an abhorrence of self-fertilization. It may not be out of place to hazard a reason for this course:

There would seem to be two distinct principles in relation to form going along together with the life of a species. The tendency of the one force is to preserve the existing form; the other to modify, and extend it to newer channels The first we represent by the term *inheritance*, the other we understand as *variation.* Inheritance struggles to have the plant fertilize itself with its own pollen; whilst the efforts of variation are towards an intermixture of races or even neighboring individuals, rather than with members of the one brood or family. May it not be possible that at some time in their past history all species of plants have been hermaphrodite? that Diœcism is a later triumph of variation, its final victory in the struggle with inheritance? There are some difficulties in the way of such a theory, as there are with most of these theories; but it seems clear from this case of *Epigæa* that cultivation has not so much to do with changes as it gets credit for, and we may readily believe that, independently of external circumstances, there is a period of youth and a period of old age *in form* as well as *in substance*, and that we may therefore look for a continual creation of new forms by a process of vital development, just as rationally as for the continued succession of new individuals.

The discovery of diœcism in *Epigæa* is interesting from the fact that it is probably the first instance known in true *Ericaceæ.* In the *Ericale* suborder of *Francoaceæ*, abortive stamens are characteristic of the family, and in the *Pyrolaceæ* antherless filaments have been recorded.

Monœcism in LUZULA CAMPESTRIS.

BY THOMAS MEEHAN.

The recent discovery, that many plants structurally hermaphrodite are practically monœcious or diœcious, in consequence of the flower being so arranged as to prevent self-impregnation, is so interesting that every additional fact bearing on the subject has a value.

Luzula campestris, D. C., adds another to the list. The three stigmas are protruded through the apex of the flower bud some days before the sepals open and expose the anthers. In the specimens I marked for observations, six days elapsed before the flower opened, after the pistils had been protruded to be operated on by the pollen of other flowers. This was in a cloudy week, and probably the exact time might vary with the weather. In all cases the stigmas wither away before the flower opens.

After fertilization the stigmas generally twist around one another, and after the anthers have shed their pollen they twist in the same way, withering up in a very short time. An interesting fact in *Luzula* is the slight adhesion at the articulation of the subpedicels with the main flower stalk,—the gentlest force being sufficient to draw them out of their sheaths. It is perhaps owing to this weakness that the pedicels are often drooping when in fruit.

June 2d, 1868.

MR. VAUX, Vice-President, in the Chair.

Twenty-five members present.

The following papers were presented for publication:

"Description of seven new species of Unio from North Carolina." By Isaac Lea.

"Descriptions of two new species of Unionidæ from Equador." By Isaac Lea.

"New Unionidæ, Melanidæ, &c., chiefly of the United States." By Isaac Lea.

"On Agaphelus, a genus of toothless Cetacea." By Edw. D. Cope.

Dr. Leidy called attention to some specimens of Sombrero Guano containing about 90 per cent. of phosphate of lime. This substance was noticed some years ago by him under the name of Ossite. A similar material has been found near Charleston, S. C., in a post-pliocene formation.

E. D. Cope gave an account of his discovery of the fresh-water origin of certain deposits of sand and clays in west New Jersey, which he found to contain leaves of dicotyledonous trees, ctenoid fish scales, and numerous Unionidæ in a tolerably good state of preservation. The most important part of the deposit consisted of a heavy black clay, which is used for making brick, which rests on a bed of hard laminated clay, with a thin layer of iron-stone between. The clay bed, at one place examined, is 25 feet in thickness, and at from one to three feet from its bottom occurs a bed of fresh water mussels. These are Unios and Anodontas of six species, all of them, as pointed out to him by Dr. Lea, hitherto undescribed, and having some analogy with those of the Wealden, procured by Dr. Mantell in England. The beds are from the top of the clay down, conformable, and have a dip of about 25° to the south-east. The upper surface of the clay is worn into holes, which are filled by the material of a bed of coarse gravel of little depth, which covers the whole. Above this is a bed of fine sand, varying from six to fifteen feet in thickness to the soil. The point at which the section is visible is in New Jersey, on the banks of the Delaware, about six miles above Camden, N. J.

These deposits belong to Meek and Hayden's Earlier Cretaceous, No. 1, which contains abundant remains of leaves on the Raritan River, but no animal fossils. Their age has been heretofore quite uncertain; they have been stated by Meek and Hayden to be the earlier division of the later Cretaceous of the general geologic series. They extend across the States of Delaware, Maryland and Virginia. In Maryland they are stated by Ducatel to contain the important deposits of carbonate of iron; and Philip Tyson, State Geologist, informs me that these beds lie upon the red and blue clays, forming hills, which have been produced by erosion of the valleys to the beds below. These iron clays contain several species of Cycadaceous plants, whence Tyson infers the age of the clays to be Jurassic, and not Cretaceous.

There are in the Museum of the Smithsonian Institution, Washington, several specimens of fossil Unios, from a ferruginous clay which crops out at some elevation on the banks of the Potomac. These species are identical with those which have been found in the New Jersey clays, and the deposit is doubtless the same as that which traverses the State of Maryland.

Indurated grey clays on the Rappahannock River have been examined by my friend Philip R. Uhler, of Baltimore, who has obtained from them leaves and stems of some six species of plants, in beautiful preservation, of the orders Cycadaceæ,? Gnetaceæ and Filices. The position and character of this bed renders it exceedingly probable that it is a continuation of those of Maryland and Alexandria.

The whole formation indicates the existence of an extended body of fresh water, having a direction and outline similar to that in which were deposited the red sandstones and shales of the Triassic belt, which extends parallel to its north-west margin throughout the States in which it occurs, separated, except in New Jersey, by a broad band of Gneiss, and Potsdam rocks. The carbonate of iron was no doubt deposited in a bog or bogs along its margin or in its shallows, as the bottom became elevated, as suggested by Tyson,—though not in a salt-water swamp, as supposed by him. The cycads and dicotyledonous trees grew in the swamps and on the shores, while terrestrial reptiles of large size no doubt haunted their shades.

These beds appear to dip conformably beneath the lower Cretaceous marine beds in New Jersey, in which, at a distance of a few miles from their border, occurred the remains of the Hadrosaurus; and it is therefore not probable that they were cotemporary with these, as is the case with the Wealden of Kent and the Cretaceous at Maidstone, England. The Hadrosaurus clays, belonging to the upper Cretaceous, as indicated by the presence of many molluscs of the Ripley Group of Mississippi, appear indeed to be separated from the clays in question by a great lapse of time. The age is therefore probably truly Wealden or Neocomian.

These facts indicate the existence of a barrier to the eastward of their present position, which for a long period prevented the access of salt water. This barrier was no doubt an anticlinal of the Appallachian series, outside of that which walled in the Triassic fresh-water area, and, like it, parallel with the general series of anticlinals of the present Allegheny range. That it was, like the latter, at one time submarine, and, gradually rising, finally enclosed the area in question, the waters of which soon became fresh, from the numerous rivers which flowed into it.

On the gradual elevation of this fresh-water valley, with its included beds of clays, etc., the Delaware river cut its way through the latter nearly to the south-eastern rise, and was then deflected along the base of these first elevations of the bounding anticlinal, in a south-west direction. Thus is accounted for the apparently singular phenomenon of the great bend of the Delaware River, near Bordentown. For after penetrating the high ranges of the Blue Mountains, it remains to be turned, apparently, in a level country of sands and clays.

We must suppose the coast line to have been not far from the south-eastern base of this anticlinal, and that a subsequent submergence brought the marine deposits near to the margin of the fresh, and gave the latter the south-east dip visible at the section at the Pea Shore. I have not yet been able to ascertain the relative position of the margins of these beds, nor the nature of those that conceal the supposed anticlinal. A system of borings at a distance of two or three miles from and parallel to the Delaware, would do much towards explaining this point. It is to be hoped that this may be undertaken by the present State Survey, under Prof. Cook.

At the present time, the cities of Alexandria, Washington, and Baltimore stand upon its deposits, and Philadelphia is probably underlaid by its margin, as well as the adjoining margin of the Gneiss. Indeed, the location of the prominent cities of the Atlantic States appears to have been determined by the fine sites and water-powers offered by the junction of the high rolling country of the Gneiss formation, and the lower and more level regions of the supposed Neocomian, Cretaceous and Tertiary. Where the Gneiss strikes the ocean, is situated our greatest seaport, New York. Trenton, Philadelphia, Wilmington, Baltimore, Washington, Alexandria, Richmond, Raleigh, Columbia, and Milledgeville, Georgia, are all on this line of junction. The elevated Gneiss hills furnish healthy and beautiful residences, the fall furnishes water-power, and the lower level, water communication, and a light soil most suitable for gardening and the production of provisions for these centres of population.

The succession of strata is rather more complete in New Jersey than has been generally supposed. At the basis of the series occurs the present fresh-water period. Then the marine Hadrosaurus or Ripley clays, and lower Greensand bed. This deposit my friend John Smock, first assistant of the State Survey of New Jersey, informed me had not found to contain Chelonians. On examination of my own collections and explorations, and those of the Academy, I find this to be true up to the present time. The Chelonians, then, have so far been found in the middle bed of green sand only. Third, the sands, green sand, and limestone pertaining to the middle bed. Lastly, the upper green sand bed, which appeared to approximate closely the London clay, or lower Eocene, in the character of its fauna, in its molluscs, according to Conrad, and especially in the genus of serpents, Palæophis of Owen.

June 9th.

The President, Dr. Hays, in the Chair.

Thirty-seven members present.

The following paper was presented for publication :

"Descriptions of Unionidæ from the Lower Cretaceous formation of New Jersey." By Isaac Lea.

The death of Mr. Matthew Newkirk, member of the Academy, was announced.

June 16th.

The President, Dr. Hays, in the Chair.

Twenty-one members present.

The following paper was presented for publication :

"A sketch of the Natural Order Liliaceæ, as represented in the flora of the States of Oregon and Calfornia, with special reference to the plants collected in an excursion along our Pacific Coast, A. D., 1866, now in the herbarium of the writer." By Alphonso Wood.

June 23d.

The President, Dr. Hays, in the Chair.

Thirty members present.

The following papers were presented for publication :

"Notice of some vertebrate remains from Harden Co., Texas ;"

"Indication of an Elotherium in Texas ;"

"Notice of some reptile remains from Nevada ;"

"Notice of some vertebrate remains from the West India Islands." By Joseph Leidy, M.D.

Prof. Cope presented to the Academy some remains of extinct Cetacea from the Miocene bed of Maryland. Of these, some vertebræ, belonging to adult and young individuals, were stated to belong to a species and genus which had not been characterized. He stated that the form was allied to Priscodelphinus in its slender and pointed diapophyses of the lumbar and caudal vertebræ, but differed in the concave centrum, with four processes clasping the epiphysis. It was named Ixacanthus cœlospondylus.

The portion of the mandibular ramus of the smallest known finner whale was presented to the Academy and named Balænoptera pusilla. The length of the species was stated to have been about eighteen feet, or equal the new born young of the modern fin-backs. Some vertebræ in the collection were also supposed to belong to the same.

He mentioned that he had opportunity of examining a portion of a specimen of the Scrag Whale of Dudley, Balæna gibbosa of Erxleben, and ascertained that it represented a genus not previously known. It was a fin-back whale, but without dorsal fin or throat folds, resembling superficially the genus Balæna. The baleen short and curved. The genus was called Agaphelus.

A second species of the genus was to be found in the "gray whale" of the coasts of California. The baleen of this species, compared with that of the A. gibbosus, was longer and had narrower basis. The plates moderately and simply concave, while those of the latter are sigmoidal, most curved near the outer margin in cross section. The bristles of the California species were very coarse, varying from one to three series between the enamel plates. The bristles of the A. gibbosus much finer, three series together. Length of the latter 8·5 inches, width at base 4·4 inches. In the gray whale or Agaphelus glaucus Cope, 22 inches in length, width at base 6 inches. In the former nearly 6 in an inch, in the latter 2½. The baleen of the A. gibbosus belonged to an immature specimen of 35 feet in length.

June 30th.

The President, Dr. Hays, in the Chair.

Thirty-nine members present.

The amendment to Art. XXI, Chap. XIII, was adopted, as follows:

"The Department A shall be denominated the Biological and Microscopical Department of the Academy of Natural Sciences of Philadelphia."

Articles VI, VII and VIII, Chap. XIII, were amended to read according to the original tenor, as follows:

"ART. VI.—Each department formed as herein provided, shall elect its own officers and members.

"ART. VII.—Every candidate for admission into a Department shall be proposed in writing by two of its members at one meeting, and be ballotted for at the meeting next succeeding.

"The affirmative vote of three-fourths shall be necessary to elect a candidate, but no election of members or of officers of a Department shall be valid unless there be present at the meeting six legal voters.

"ART. VIII.—Every member elect shall pay to the Treasurer of the Department an initiation fee and a semi-annual contribution, the amount of which shall be determined by the members of the Department, provided that a Department shall not assess its members at a rate exceeding two dollars for initiation and two dollars semi-annual contribution. In other respects the By-Laws, Chap. II, which govern the election of members and correspondents of the Academy, shall apply also to the election of members of any of its Departments."

The following gentlemen were elected members:

Roger Sherman, John E. Carter, Francis P. Steel, Wm. Thompson, M.D., Wharton Barker, Isaac Comly, M.D., Silbert Combs, L. S. Bolles, M.D., J. F. Holt, M.D.

The following were elected correspondents:

Prof. Jas. Orton, Dr. Boynton.

On favorable report of the Committees, the following papers were ordered to be printed:

Descriptions of seven new species of UNIO from North Carolina.

BY ISAAC LEA.

Unio dorsatus.—Testa lævi, triangulari, ad latere planulata, inæquilaterali, postice subbiangulari, antice rotundata; valvulis subtenuibus, antice crassiusculis; natibus prominentibus: epidermide rufo-fusca, subsquamosa, obsolete radiata, dentibus cardinalibus parvis corrugatisque, lateralibus longis, lamellatis subcurvisque; margarita vel alba vel purpurea vel salmonea et valde iridescente.

Hab.—Catawba River, N. C., C. M. Wheatley.

Unio datus.—Testa lævi, lato-elliptica, valde compressa, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis subcrassis, antice parum crassioribus; natibus prominulis; epidermide rufo-fusca, micanti, obsolete radiata; dentibus cardinalibus parviusculis, sulcatis erectisque; lateralibus prelongis, subcurvis, lamellatis corrugatisque; margarita nubila, salmonea et purpurea et valde iridescente.

Hab.—Paw Creek, Beaver Creek and Long Creek, N. C., C. M. Wheatley.

Unio Beaverensis.—Testa lævi, oblonga, compressa, ad latere planulata, inæquilaterali, postice obtuse angulata, antice rotunda; valvulis subcrassis, antice parum crassioribus; natibus subprominentibus; epidermide rubiginosa, micanti, obsolete radiata; dentibus cardinalibus longis, crassis, lamellatis subrectisque; margarita vel alba vel purpurea et valde iridescente.

Hab.—Beaver and Long Creeks, N. C., C. M. Wheatley; Carter's Creek, Ga., J. Postell.

Unio nubilus.—Testa lævi, oblonga, subcompressa, inæquilaterali, postice subbiangulari, antice rotundata; valvulis crassis, antice crassioribus; natibus prominulis; epidermide tenebroso-fusca, eradiata; dentibus cardinalibus crassis, sulcatis corrugatisque; lateralibus crassis, longis, corrugatis lamellatisque; margarita nubila, salmonea et purpurea et iridescente.

Hab.—Paw Creek, Mecklenberg Co., N. C., C. M. Wheatley.

Unio Pawensis.—Testa lævi, suboblonga, inflata, valde inæquilaterali, postice subbiangulari, antice rotundata; valvulis subcrassis; natibus subprominentibus, subtumidis; epidermide tenebroso-fusca, squamosa, eradiata; dentibus cardinalibus parvis, corrugatis, subconicis; lateralibus longis, lamellatis subcurvisque; margarita vel alba vel purpurescente et iridescente.

Hab.—Paw Creek, Beaver Creek, and Catawba River, N. C., C. M. Wheatley.

Unio humerosus.—Testa lævi, elliptico-oblonga, compressa, ad latere planulata, inæquilaterali, postice obtuse biangulari, antice rotunda; valvulis subcrassis, antice crassioribus; natibus prominulis; epidermide rufo-fusca, obsolete radiata; dentibus cardinalibus grandibus, sulcatis, partitis; lateralibus prelongis, lamellatis corrugatisque; margarita salmonis colore tincta et valde iridescente.

Hab.—Charlotte, Mecklenberg Co., N. C., C. M. Wheatley.

Unio genuinus.—Testa lævi, elliptica, subinflata, inæquilaterali, postice subbiangulata, antice rotundata; valvulis subtenuibus, antice crassioribus; natibus subprominentibus; epidermide luteola, valde radiata; dentibus cardinalinalibus erectis, pyramidatis, in utroque valvulo duplicibus; lateralibus longis, subcurvis lamellatisque: margarita alba et iridescente.

Hab.—Bissel's Pond, Charlotte, N. C., C. M. Wheatley.

Description of two new species of UNIONIDÆ from Equador.

BY ISAAC LEA.

Unio Ortonii.—Testa plicata, lato-elliptica, compressa, valde inæquilaterali, postice angulata, antice rotundata; valvulis crassis, antice crassioribus; natibus prominulis; epidermide rufo-fusca, eradiata; dentibus cardinalibus multipartitis, flexuosis curtisque; lateralibus prelongis, curvatis corrugatisque; margarita albida et valde iridescente.

Hab.—River Napo, Equador, S. Am., Prof. Orton.

Anodonta Napoensis.—Testa lævi, oblongo-elliptica, subcompressa, valde inæquilaterali, antice et postice rotundata; valvulis subcrassis; natibus prominulis; epidermide tenebroso-fusca, encarpiformi, flexuosa, obsolete radiata; margarita pallido-viridi, non iridescente.

Hab.—River Napo, Equador, S. Am , Prof. Orton.

Descriptions of UNIONIDÆ from the Lower Cretaceous Formation of New Jersey.

BY ISAAC LEA.

Prof. Cope very kindly placed in my hands the specimens of *Unionidæ* which he collected in a bed of *bluish clay*, now first observed to contain them, about six miles north-east of Camden, N. J. This bed is subordinate to the *Green Sand*, so long known to our geologists as belonging to that portion of the Cretaceous group which furnished so many interesting organic remains within the last forty years, particularly the *Hadrosaurus Foulkii*, Leidy, and the *Lælaps aquilunguis*, found by Prof. Cope. The same member of the *Green Sand Formation* has been very productive also of marine *mollusca*, some of which I described in our Proceedings from the beds near Haddonfield, N. J. But, as observed above, no *fresh water* remains had been found in these cretaceous beds there, and the unexpected development of these *Unionidæ* by Prof. Cope, it is hoped, may lead to other and more extensive results.

These interesting beds in New Jersey have only yet had a very slight development. They will, no doubt, continue to yield their natural treasures to the industrious investigator for many years. The late Prof. Vanuxem, as early as 1818, while examining the Paris basin, was convinced that these New Jersey beds had their equivalent in the *Green Sand* of Europe; and subsequently, in 1828, his notes were published in the Journal of the Academy, where he gave a table of their "relative geological position."

Prof. Cope procured nearly forty specimens of *Unionidæ*, and these are composed of ten species, viz.: eight *Uniones* and two *Anadontæ*. These consist almost altogether of casts, but the forms are well preserved, and in some specimens the inner layers of the nacre are remaining in fragments. These fragments, submitted to the microscope, exhibit the imbricated structure as developed by Prof. Carpenter in the *Unionidæ*, but I could not detect any of that portion of the outer structure of the nacre where the base membrane is deposited in the peculiar cellular structure described and figured in his work. The impress of the muscular cicatrices is visible in many of the specimens. These cicatrices being placed in their usual positions, shewing even the dorsal and palleal scars. While all the massive structure of the cardinal and lateral teeth have been decomposed and carried off, their impress in the clay remains perfect, showing the same forms and striæ which are found in the massive cardinal and lamellar teeth of our western species.

As there are no characters of the shell itself left in any one of the specimens, to designate specific differences, either by form of teeth, color of nacre, or epidermal rays, it remains only to take the outline, transverse diameters, and general curves, to group these specimens. In so doing, I have made these groups conform to the most known species, and named them accordingly. Among these specimens I have noticed none which have nodules or folds, while there is a general resemblance in size and form to those now inhabiting the rivers of the Ohio basin.

As the bed in which these fresh-water shells are found lies below the well-known deposits of "green sand or marl beds," it becomes a very interesting question as to its relations to these superimposed beds. Further investigation can alone give us the data to settle this point. In finding these fresh-water *molluscs* here, we are naturally brought to consider how far they may have relation to the products of those deposits in Europe, where the same genera of fresh-water shells have been found abundant; I mean of course the *Wealden* of England, in which the distinguished geologist Dr. Mantell had worked so successfully, and in which he found the *Iguanodon Mantelli*, a gigantic terrestrial reptile, and other animals, together with many fresh-water *molluscs*, particularly a large number of *Unionidæ*, analogous in form to these now so happily found by Prof. Cope in this bed below the *Green Sand.**

I ought to state, in connection with this subject, that Dr. Hayden published with Mr. Meek, some ten years since, observations made by the former regarding the estuary and fresh-water deposits near the mouth of the Judith River, where Dr. Hayden found *Uniones*, *Paludinæ*, &c. These geologists, considering it the lowest, have called this number one. They say in their paper, published in our Proceedings May, 1857, that "the estuary and fresh-water deposits at the mouth of the Judith River are probably in a parallel with the lowest bed of the great Lignite basin, though some portions of them may be somewhat older."

Unio nasutoides.†—Shell smooth, very wide, compressed, very inequilateral, biangular behind, rounded before; beaks slightly raised, nearly terminal; cardinal teeth short and striate; lateral teeth long, and nearly straight.

Length 1·5 inches, breadth 4·6 inches.

Remarks.—This species is very nearly the same in outline with the well-known *nasutus*, Say, but it is more acute at the posterior margin, in which character it is more nearly allied to *Fisherianus* (nobis).

Unio radiatoides.—Shell smooth, regularly elliptical, compressed, inequilateral, subangular behind and rounded before; beaks slightly raised, submedial; cardinal teeth large; lateral teeth large, rather long and lamellar.

Length 2·4 inches, breadth 4·3 inches.

Remarks.—Some of the large and compressed varieties of *radiatus*, Lam., are nearly of the same outline with this species, and the beaks are nearly in the same position. It is evidently a species of thickness and weight.

Unio subrotundoides.—Shell smooth, subrotund, very much compressed, very inequilateral, rounded behind and before; beaks slightly raised, nearly terminal; cardinal teeth apparently small; lateral teeth long, lamellar and arched.

Length 2·6, breadth 3·4 inches.

Remarks.—Very nearly of the same outline with *subrotundus* nobis, but not so high in the beaks. The lateral teeth seem to be unusually long and curved.

Unio carriosoides.—Shell smooth, broadly elliptical, somewhat inflated, obtusely angular behind, rounded before; beaks somewhat raised, removed from medial; cardinal teeth ——— ; lateral teeth long and slightly curved.

Length 2·5, breadth 4·8 inches.

Remarks.—This is evidently a very regularly formed species, the curves being gentle and pleasing. It resembles in outline some of the more transverse large males of *carriosus*, Say.

Unio humerosoides.—Shell smooth, ovately oblong, very much compressed, rounded behind and before; beaks slightly raised, removed from medial; cardinal teeth large and compressed; lateral teeth rather long and slightly curved.

Length 2·6, breadth 4·2 inches.

* While in London in 1852, my friend Dr. Mantell consulted me in relation to these *Unionidæ* from the Wealden, of which he had several hundred specimens, with the intention of publishing them. For this purpose I grouped the whole of this fine collection, and assimilated them to those of our existing western species. Owing to severe illness, from which he never recovered, Dr Mantell did not publish these shells, and his collection was dispersed by a public sale. On my return from the continent to London, fifteen months afterward, I found in the cabinet of the late distinguished geologist, Mr. Sharp, a portion of them, which he had purchased, and which still had the labels which I had written for Dr. Mantell. I am not aware of any of these having been published.

† These descriptions are of course imperfect, being little more than from casts. Specimens of all the species are deposited in the cabinet of the Academy of Natural Sciences.

Remarks.—A rather unusual outline, and more like some South American species than our own, except *humerosus* (nobis), which it is closely allied to. The exterior is very much and coarsely striate.

Unio Roanokoides.—Shell smooth, very wide and slightly curved at basal margin, compressed towards the beaks, rounded before and behind; beaks slightly raised, well advanced towards the anterior margin; cardinal teeth rather large, very much striate; lateral teeth very long, lamellar and slightly curved.

Length 2·6, breadth 4·8 inches.

Remarks.—The form of this species is very unusual, and it is nearest in outline to *Roanokensis* and *macer* (nobis). A portion of the nacre remains on the specimen, but there is no appearance of rays on this or any other of these specimens. The anterior portion is remarkably compressed for a *Unio;* this character somewhat applies to others which accompanied it.

Unio ligamentinoides.—Shell smooth, elliptical, very much compressed, very inequilateral, angular behind and rounded before; beaks slightly raised; cardinal teeth compressed; lateral long, lamellar and curved.

Length 2·3, breadth 3·5 inches.

Remarks—The outline and general appearance of this shell is nearly that of a compressed male *ligamentinus*, Lam., but rather more arched above. The curves are regular, and no doubt that in a perfect state it must have been attractive as its prototype now existing is.

Unio alatoides.—Shell alate, smooth, subelliptical, very much compressed, inequilateral, rounded before and behind; beaks raised; cardinal teeth oblique and compressed; lateral teeth long, large, lamellar and very slightly curved.

Length 2·9, breadth 4·2 inches.

Remarks.—A single specimen only is before me, and this by no means perfect. It is very closely allied to *alatus*, Say. The anterior dorsal portion of one valve is gone, and that of the other valve is crushed, but the posterior portion is in a very good state, showing a perfect and deep mould of the large, regular, lamellar lateral tooth, over which the posterior dorsal portion of the disk extends into a well-defined wing, which was connate above, but not extending so high as in *alatus.*

Anodonta grandioides.—Shell smooth, elliptical, very much inflated, ventricose, obtusely angular behind, obliquely rounded before; beaks submedial, flattened at the tips, but very much inflated on the umbos.

Length 3·3, breadth 4·9 inches.

Remarks.—This species is more like *grandis*, Say, than any other of our western *Anodontæ.* It is about the same size, and of very nearly the same outline. Both the valves are present, and in their natural relevant positions. The umbos are much inflated, but not so much as the other species (*corpulentoides*) herein described.

Anodonta corpulentoides.—Shell smooth, rotundo-elliptical, exceedingly inflated, very ventricose, obtusely angular behind, rounded before; beaks submedial, flattened at the tips, but excessively inflated on the umbos.

Length 3·6, breadth 6·5 inches.

Remarks.—This species is so nearly like *corpulenta*, Cooper, that I have no hesitation to consider it nearest in outline and form to that remarkable species, described by the late Judge William Cooper, and which inhabits the Lake of the Woods, and other north-western waters. There is no mistaking the peculiar great enlargement of the umbos of this species being analogous to *corpulenta.* There are two imperfect specimens before me, but the larger one has the anterior half of the right valve and posterior half of the left valve, which enables me to make a nearly correct description and measurement.

A sketch of the Natural Order LILIACEÆ, as represented in the Flora of the States of Oregon and California, with special reference to the Plants collected in an Excursion along our Pacific Coasts, A. D. 1866.

BY ALPHONSO WOOD.

(Commencing at San Diego, Jan. 28, I made wide excursions in that vicinity until Feb. 19. Here the hills are covered with four species of the Cacti, with other plants. Thence journeying north, I visited the splendid plains of San Louis Rey, and of Anaheim, &c. Arrived at Los Angeles on the 23d. Here flourish almost all the tropical, together with the temperate fruits, in great abundance. My daily excursions here extended to San Gabriel, to the Granite Mountains north and east, to Cocomungo and San Bernardino east, and to San Pedro west. Next journeyed to San Buenaventura,—a most delightful trip, much of it on the beach. Hence diverged to Ojai Ranch and the Sulphur Mountains. Thence to Santa Barbara, known for its grand Mission church, still in good repair. On the 28th of March I left for San Louis Obispo, where I spent three days on those magnificent plains and lofty buttes. Next on the Salinas Plains, the Gavilan Mountains, and the vicinity of Monterey four days, and April 4th to 7th in the rich Pajaro Valley and adjoining Redwood Hills. April 7th to 17th botanized in the remarkable region of Santa Cruz, and the following week on the splendid plains and hills of Santa Clara and San Jose, south and east of the Bay. April 23d to May 6th, in the vicinity of San Francisco, San Mateo, Oakland, &c.

Our next journey was to the Giant-wood of Calaveras, with side excursions to Sacramento, Lincoln, Folsom, Murphy's and Vallecito, returning on May 31st. The plains were now dressed in their most brilliant robes, in which the golden and purple Mariposas shone conspicuous.

A trip to the Geysers commenced June 1st, when the Geyser Mountains were red with Clarkias. In this journey we visited Petaluma, Sevastopol, Santa Rosa and Healdsburg, which latter place yields a rich harvest to the botanist. Returned June 7th.

Next day commenced our long tour northward, again visiting Sacramento, Marysville, and exploring the Yuba River to near Downieville. Thence Oroville, Chico, are visited; Red Bluff and Shasta, where I explored the head-waters of the Sacramento. Thence over the Trinity Mountains, where Brevoortia had long bloomed unknown, and over Scott's Mountain, reaching Yreka June 17th From this place enjoyed a grand excursion over the volcanic plains, thirty miles, to Mt. Shasta.

June 21st crossed the State line, on the Siskiyou Mountains, into Oregon, and for three days explored the splendid valley of Rogue River, in the vicinity of Jacksonville. Next three days were spent in pleasant excursions up and down the Umpqua Valley, from the bright little town of Wilbur. At Eugene, 100 miles to the north, entered the vast plains of the Wahlamette River. Reached Albany July 1st, and Salem, the capital of Oregon, July 4th. Here spent three days in botanic trips, in company with Dr. Wythe of the Wahlamette University. Hence thirty miles to Oregon City, a place of infinite water-power, and one hundred miles from Eugene,—the entire length of this great valley. Hence to Portland twenty miles, and to the ocean one hundred miles navigation for the largest steamers.

From the city of Portland, June 9th to 17th, my long excursions radiated, usually in excellent company. By the waters of the Great Columbia I reached the Dalles on the 18th, laboring diligently one week, with Judge Wilson often as guide. Returning, spent one day at the famous Cascades, where the river has torn asunder the mountains, which are supported on columns of basalt. Next I am perambulating the rich woods and meadows of Forest Grove, twenty-five miles west of Portland. A day at Milwaukie, Oswego and Oregon City, where friends and botanists had already collected herbaria for my use. August 7th to 11th at Astoria, and Clatsop Plains, at the mouth of the Columbia. Once more reach, and leave Portland, accompanied by friends brave and true (Dr. Atkinson, J. Deerdorf, &c.), for the Cascade Range and Mt. Hood, in full view sixty miles eastward. On that awful summit we stood Aug. 20th, and estimated its height at 17,000 feet,—water boiling at 180° Fahr.

On the 25th, started from Monticello, Washington Territory, in a canoe rowed by Indians, on a two days' excursion up the Cowlitz River. Everywhere in dark, gloomy forests of the Douglas Fir (Abies Douglasii),—would supply the world with lumber for a thousand years. Finally, on the 31st, leave Portland by steamer Montana for the Pacific, and for San Francisco, 600 miles distant.

Our final excursion was to the Yosemite,—last, not least. A day or two at Benicia and around Mt. Diablo (whose flowers had already been gathered for me by Rev. J. P. Moore), once more at Stockton, and across the vast plain to Bear Valley, Mt. Bullion, and Mariposa, and I surveyed alone the Giant-wood of Mariposa. Four days I went up and down in Yosemite, plucking flowers from the bases of cloud-capped rocks, and on the 22d of September am again in San Francisco, whence, on the morning of the 29th, with many a trophy, I embarked for home.)

Tribe I.—*TULIPEÆ.*

ERYTHRONIUM GRANDIFLORUM, Pursh. Scape tall (1—2 f.), 1—3-flowered; perianth segments yellow, acuminate, reflexed from near the base; stigmas 3, distinct, revolute; leaves spotless.—Woods, from the Sacramento to the Columbia River, and northward. Bulb oblong-ovoid. Flowers (when more than one) racemed, as if by the splitting of the scape.

β. multiflorum (Torr.) Flowers 5—8 in the raceme.—Sierras.

γ. multiscapidea (Kellogg). Scapes several, all radical, each 1-flowered.—Sacramento Valley (Dr. Stillman. V. s. in herb. Torrey). A remarkable plant; but the scape is often one only, and then undistinguishable from var. *α*.

E. GIGANTEUM Lindl. Scapes 5 or 6-flowered; segments acuminate; stigmas united and club-shaped, somewhat 3-lobed.—Oregon to Idaho (Mr. E. Walker), and northward. My specimens are all 1-flowered, and too small to justify Lindley's name. Flowers straw-yellow.

LILIUM CANADENSE, *β. puberulum* (Torr.?) Tall, strict (3—4 f.); stem and peduncles minutely puberulent; leaves some opposite, some verticillate, often some scattered; flowers few (often but one); segments orange-yellow, with brown dots, oblong, reflexed from below the middle; anthers oblong; stigma entire, 3-lobed.—Yuba Co. to the Columbia. Flowers large, showy, 1—7. June, July.

γ. minus.—Glaberrimum; foliis plerumque sparsis; flore sæpius unica *β* dimidio minore; antheris ovalibus, basi affixis.—Meadows near Mt. Shasta, and in Oregon. June. (Var. *parviflora* Hook. is undescribed.)

δ. Walkeri. Floribus multis (12—15) minimisque (policaribus); racemo elongato; foliis verticillatis —Idaho (Mr. Elkanor Walker).

L. WASHINGTONIANUM (n. sp.) Glaberrimum; foliis plerumque verticillatis, oblanceolatis vel obovatis, breviter acuminatis; floribus permagnis, infundibuliformibus, basi attenuatis, umbellatis vel sæpe solitariis, subnutantibus; segmentis spatulatis, apice cuspidatis, basi longe angustatis, supra recurvatis, 3-policaribus; intus fusco-maculatis, odoratissimis; anth. oblongis; stig. integro.—In woods here and there, from Yosemite to the Columbia. 3—5 f. Flowers purple, varying to white.

This splendid lily seems to have been overlooked by the botanists, or confounded with the preceding. It is well known to the miners, who recognize its superior qualities, and call it the "Washington Lily."

FRITILLARIA, Tournef.

* Flowers tessellated, purple and yellow. Caps. 6-winged.

F. MUTICA Lindl. Stems many (3—9)-flowered, naked below; leaves verticillate, linear-lanceolate, obtusely pointed; flowers racemed, nodding, bell-form, as long as the pedicles (1′); segments oblong, acutish, tessellated with dull purple and greenish-yellow; style trifid; capsule 6-winged.—California; common in the interior. 2—3 f. Lvs. 2—3′. The one radical leaf is ample, elliptical. Bulb of white, thick scales. April, May.

β. foliosa.—Procera; foliis majoribus (5—6′); floribus parvulis, segm. linearibus, 9′′.—In deep shades, Redwood hills. 3—5 f.

F. LANCEOLATA Ph. Stem strict, 1—2-flowered; leaves lanceolate and linear-lanceolate, verticillate or opposite; flowers nodding, obconic, obtuse at base, longer than their pedicels; segments oblanceolate, rather obtuse, tessellated with purple and yellow; caspule broadly 6-winged.—Monterey to Portland, north and east. 1—2 f. Lvs, 2—3′. Stem naked below, as in *F. mutica*. The capsule is broader than long. It is more than probable that *F. mutica* runs into this.

F. PARVIFLORA Torr. (P. R. R. Rep. IV.) Leaves narrowly lance-linear, whorled or scattered; flowers small, few or many, in a long raceme, on short pedicels, nodding; perianth narrow at base: style trifid to near the middle; capsule 6-winged.—Santa Cruz, Gavilan Mts.! Murphy's (Calaveras Co.) Radical leaf broad. Stem lvs. about 2′ by 2′′. Flowers 1—20, greenish and purple.

** Flowers brownish-purple, not tessellated. Fr. wingless.

F. Kamtschatcensis Gawl. Bulbs granulated; leaves lanceolate, irregularly verticillate; flowers 1—3, pendulous, brown-purple, spotless, bell-form, much longer than their pedicels; segments lance-elliptical, acute, veins inside more or less lamellated; nectaries oblong; capsule obtusely 6-angled.—Coast, San Diego to Sitka (and Kamtschatka). The bulb consists of thick farinaceous scales, loosely conjoined. Stem 8—12′. February—April. (*F. biflora* Lindl.)

F. recurva Benth. Stem tall, naked at base; leaves linear or oblong-linear, some whorled near the middle of the stem; flowers several, subcylindrical, suberect; *segments oblong, reflexed* at the end, longer than their pedicels; stigmas subconnate; ovary oblong, fr. wingless.—California (Hooker), Umpqua Valley, Oregon (Mrs. Royal). 2 f. Flowers 1½ inches long, light purple.

*** Flowers yellow. Capsule wingless.

F. liliacea Lindl. Stem leafy at base; leaves oblong-lanceolate and linear, the lower whorled or opposite; flowers 1—5, racemed, nodding, bell-form, with a narrow base, yellow; pedicels erect, longer than the bracts; capsule oblong, blunt at both ends; style 3-cleft.—San Francisco (Dr. Stillman), Benicia (Rev. J. P. Moore), to Nevada. 8—14′. Nectary a groove. Very pretty. March.

F. pudica Spreng. Low; leaves lance-linear and linear, opposite or scattered; flower solitary, nodding, bell-form, yellow; peduncle as long as the bract, recurved at top; segments oblong-obovate, obtuse; style and stigma undivided; ovary wingless.—Dalles of the Columbia (Mrs. Wilson), and east. 6—9′. Leaves few, 3′. Nectaries nearly obsolete, hence first named by Pursh a *Lilium* (*L. pudicum*).

Yucca aloifolia L.?—Hills, near the Hot Springs, San Bernardino (March 10th), only the leaves and the dead scapes of the preceding year. Leaves densely capitate near the ground, 12—15′ by 1′, very rigid, sharply serrulate, glaucous, ending in a strong spine. Scapes very stout, 10—15 f. high.

Y. graminifolia (n. sp.?)—Mountains twelve miles east of Los Angeles (March 3d). Saw only leaves, and dead scapes with the fruit. Leaves very numerous, in a dense radical crown, linear, 2 f. by 3—4″, glaucous, not very rigid, rough-serrulate, round-carinate, involute above, and ending in a sharp spine. Scape 10—15 f. high, paniculately branched, bearing hundreds of "white, bell-form, pendulous" (Mr. Hoover) flowers. Capsule 1′ thick, 1½′ long, 6-lobed, 6-celled, packed full of disc-form, thin, black seeds. The leaves are not at all filamentous.

Y. filamentosa L.?—Mountains east of Los Angeles, with the last. Only the leaves seen (March 3d), which are densely clustered, yellowish-green, with brown spots and transverse lines at intervals, with no midvein, thick, lance-linear, rolled above and sharp-pointed, margin splitting into strong, recurved filaments.

CALOCHORTUS, Pursh. (Καλός, beautiful, χόρτος, grass.)

(*Cyclobothra* and *Calochortus* of authors.)

Perianth 6-parted, regular, deciduous; segments distinct, contorted in æstivation; sepals oblong or lance-linear, spreading, much smaller than the petals; petals connivent or spreading, broadly obovate, cuneate-unguiculate, bearded within, with a glabrous spot above the base; stamens 6, perigynous; fil. subulate; anthers linear-oblong, deeply perforated at base where the filament is inserted; ovary free, 3-angled; style very short or none; stigmas recurved, persistent on the 3-celled, 3-valved, chartaceous capsule; seeds angular, one row in each cell.—Bulbous erect herbs of the North American Pacific States. Leaves narrow, acuminate. Flowers few, terminal, solitary, nodding or erect, showy.

The acknowledged error of Lindley, Kunth, &c., of referring the *original species* of Pursh (*C. elegans*, A.D. 1816) to a genus invented ten years later (*Cyclobothra*, Sweet, 1826), is avoided by including both genera in one, under Pursh's name. Moreover, Sweet's genus cannot possibly be distinguished by "fovea nectarifera altè impressa" (the only distinction relied upon), for in *C. elegans* and its congeners "the pit" fades away by degrees, becoming imperceptible. If, however, the two genera be insisted on, Sweet's name must give place to the prior one of Pursh, and a new name (none more appropriate than *Mariposa*) conferred in place of the *Calochortus* of Lindley, &c. No one acquainted with these beautiful flowers will regret the disuse of so distasteful a name as *Cyclobothra*.

§ *Calochortidea.* Petals impressed inside with a nectariferous pit, which is gibbous outside, beard scattered, soft, margin ciliate-fringed.

* Perianth ventricous, pendulous.

C. PULCHELLUS. Erect, branched above; flowers globous, yellow; the upper in pairs and threes, lower often solitary, all with long bracts; sepals lance-ovate, acuminate; petals concave, connivent, fringed, twice broader than the sepals, the pits large and deep; anthers mucronate; ovary ovoid.—Mt. Diablo (Rev. J. P. Moore), and the interior of California generally, less common than the next. 1 f. Its pendulous golden globes make a fine appearance. May. (*Cyclobothra pulchella* Benth., in Hort. Trans., n. ser., i, p. 413.)

C. ALBUS Dougl. Erect or inclined, branching; flowers oblong, inflated, white, the upper in pairs, with lanceolate acuminate bracts; sepals oval, much shorter than the concave, scarcely fringed petals; anthers obtuse; ovary obovoid.—California, common in all the foot hills. 1—2 f. Leaves and bracts lance-linear and long pointed. Flowers 1′ or more long, of a delicate pearly whiteness. May, June. (*Cyclobothra alba* Benth., l. c., *C. alba* and *paniculata* Lindl.)

** Perianth expanding, nodding (not pendulous).

C. ELEGANS Pursh. Stem slender, with one radical, linear leaf; flowers in pairs or threes, open, nodding or suberect, white or purplish; sepals oblong, cuspidate, greenish-purple, the petals much larger, roundish-obovate, soft-bearded within except its purplish pit, ciliate-fringed, and a short cusp at apex; anthers acuminate, white; stigmas recurved; capsule 3-winged, finally oval and reflexed on the elongated pedicels.—In cool mountain shades, Mt. Shasta to the Columbia. 10—16′. Petals near 1′ long, the pit strongly impressed. June. (*C. Tolmæi* Hook., *Cyclobothra elegans* Lindl., Bot. Reg. t. 1662.)

β. *nanus.* Folio angustè lineari v. filiformi, florem unicum longe excedente; ped. filiformi bracteis subulatis duabus instructo; perianthii capillis fuscis. —High hills, Yreka. Also on Mt. Hood. 5—8′. June—August.

§§ *Mariposa.* Perianth erect, open. Sepals convolute-acuminate. Petals plane, erect-spreading, often spotted, but with no nectariferous pit. Seeds oval, compressed. (Vide *C. venustus*, below.)

* One radical leaf exceeding the slender stem. Petals straight, spotless? Pods oval, obtuse, nodding

C. UMBELLATUS (n. sp.) Folio radicali unico, lineari, caulem et bracteas foliosas longe excedente; floribus 5—9, fere umbellatis, erectis; pedicelis subradicalibus, longissimis, ebracteatis, fructiferis recurvatis; petalis flabelliformibus, apicè rotundatis, erosis, glaberrimis, basi squamâ ciliatâ instructis, albis, concoloribus; antheris oblongis, obtusis; capsula 3-alata—In collibus altis prope Oakland, California (legimus Sanborn et nos). Caulis 6—8 poll. Folium pedale. Petala 10 lin. Maia. (*Cyclobothra elegans*, var. Torr.? R. R. Rep. iv) Distinguished from *C. elegans* by its *many* flowers, beardless petals, entire absence of neclary, &c.

C. UNIFLORUS Hook. One radical lance-linear leaf larger than the several cauline ones; flower single, lilac, on a long, nearly radical peduncle; sepals linear, acuminate; petals triangular-fan-shaped, bearded just at base, with a small purple spot; anthers linear-oblong, obtuse, blue; style short, distinct.—High plains, Santa Cruz, &c. Scape 6′. Flower 1′ long. April. Clearly distinct.

C. NITIDUS Dougl. Radical leaf lance-linear, much larger than the few cauline, all long-pointed; flowers 3—4, orange-yellow, pedicels elongated; sepals elliptic, acute; petals same length, roundish, bearded all over inside with clavate hairs; anthers short, acuminate; capsule oval, wingless, drooping.—Yuba and Tuolumne Counties. 6—8′. Leaf 1 f. Flowers brilliant, 15″ broad. May.

β. *cornutus.* Sepalis longè acuminatis, corollam excedentibus. Flore unica; fol. angustè lineari.—Dutch Flat. 4—6′. Fl. 1′ lato.

** Stem leafy, erect, branched, rigid. Perianth large, broad-campanulate, the petals recurved-spreading above the middle, spotted (except *C. Weedii*).

C. VENUSTUS Benth. Branches few, 1-flowered; leaves few, narrowly linear; sepals lanceolate, acuminate, greenish outside, a purple eye bordered with yellow inside; petals many times larger, flabelliform, straw-white, variegated, a tuft of hairs below, a purple crescent bordered with yellow near the middle; stamens one-third as long as petals, anthers longer than filament; pod lance-oblong.—Plains and foot hills, California. 1½—2 f. Flowers 2½ inches broad. This splendid flower (with the next two) has long been known to the native Californians by the name of *Mariposa* (Spanish for butterfly).

C. SPLENDENS Benth.? Stem stout, 3—5-flowered; leaves narrowly linear; sepals lanceolate, acuminate, revolute, green, longer than the petals, a small brown spot in the middle; petals broad-obovate, rounded at apex, lilac, sparsely bearded below, a brown-yellow eye in the middle; anthers large, longer than filament (6″), blue (Bentham).—Santa Clara, &c., not rare. 1—2 f. Flowers as large as in No. 7. Perhaps it runs into that species. May.

C. MACROCARPUS Dougl. Bulb oblong; stem 5-leaved, 2-flowered glaucous; leaves convolute, sheathing at base; pedicels enlarged upwards; sepals lance-linear, longer than the petals, lilac, with a green line outside; petals obovate, short acuminate, tapering to base, lilac or bluish-purple, greenish at base inside, and with a tuft of beard; anthers acuminate, as long as filament; capsule lance-oblong, very long (3—4′).—Dalles of the Columbia, &c., common. August.

C. LUTEUS Dougl. Stem about 3-flowered; leaves convolute-acuminate, shorter than the slender peduncles; sepals oblong, pointed and recurved at apex, scarcely shorter than the petals, yellow; petals yellow, broad-cuneate, rounded at apex, bearded across the base, a roundish red spot near the middle; anthers as long as filament; capsule elliptical.—Plains of Sacramento and San Joachin. 1—2 f. Flowers smaller than in the foregoing, very brilliant. May.

C. WEEDII (n. sp.) Caule subtrifloro; foliis convolutis-filiformibus, pedunculo divaricato multo brevioribus; floribus aurantiacis-luteis, concoloribus; sep. oblongis, acuminatis, petala excedentibus, basi barbatis; pet. cuneato-obovatis, intus omnino barbatis, ciliatis, basi barbis fasciculatis; stam. fere longitudine petalorum, anth. filamentis brevioribus; ovario lineari.—San Diego (ligit *Weed*). Caulis gracilis, rigidus, 1—2 ped. Flores magnitudine *C. lutei;* pet. 15 lin. Stam. et pistilla, 1 pol. April. Very distinct.

C. NUTTALLII Torr. "Stem 2-flowered; leaves very narrowly linear; petals obovate-cuneate, rounded at summit, white except the yellow base, with an oblong dense tuft of hairs on the claw, a purple spot just above, and a few scattered hairs. (*C. luteus* Nutt.) Noble's Pass, Sierra Nevada, July 3." (P. R. R. Rep. ii, 124.) *V. s. in herb. Torr.**

* The frequent references like the above, in these pages, indicate the extent of my obligations to that eminent botanist, Dr. John Torrey, of Columbia Coll., New York.

Tribe II.—*ASPHODELEÆ.*

Camassia esculenta Lindl.—Fine specimens from Marin Co. (Dr. Stillman) to Portland (Mr. Walker, Mrs. Shepley). Bulb white, furnishing to the Indians a rich diet. Leaves broadly linear, nearly the length of the scape (12—18′); raceme 6—10-flowered. Flowers 1′ long, blue, alternate. Sepals lance-oblong, 5—7-veined. Cells of the capsule about 12-seeded.

ALLIUM, Linn.

§ Bracts of the spathe 2, rarely 1 or 3.

* Sepals acuminate, longer than the stamens.

A. falcifolium Hook. Bulb globular, white; leaves 2 or 3, linear, recurved, shorter than the scape; spathe colored, of 1 or 2 bracts, shorter than the pedicels; flowers 10—30, rose-purple, two or three times shorter than their stalks; sepals lance-ovate, carinate-acuminate, more or less glandular-serrulate, recurved, more than twice longer than the unequal stamens.—San Diego to Salem (Oregon). 10—20′. Pedicels 1′—18″. March—May. Hooker's plant had "lanceolate" leaves. None wider than lance-linear appear among my specimens.

A. Douglassii Hook. Bulb ovoid, white; leaves linear, erect, mostly two, shorter than the scape; spathe 2 bracted, about as long as the pedicels; flowers about 20, rose-purple, two or three times shorter than their stalks; sepals ovate, gibbous at base, rather acuminate, straight, a third longer than the subequal stamens.—Throughout Oregon, California and Nevada. 10—20′. Pedicels 1′. San Diego specimens have sepals broadly ovate, merely acute. Nearly allied to *A. falcifolium*, but readily distinguished by the sepals (sepals and petals).

A. acuminatum Hook.? Bulb ovoid, often purplish; leaves 2—3, narrowly linear, shorter than scape; umbel densely ∞-flowered, globular, 1′ or more in diameter; spathe 2—3-bracted; pedicels not longer than the purple flowers (3—5″); sepals ovate or oval, acuminate, gibbous at base, near twice longer than the stamens; capsule ripening 1—3 black seeds.—Hills, Santa Clara Co. to the Wahlamette. Scape 1 f. or more. Umbel small and compact, 20—40-flowered, very pretty. April, May.

β. gracile. Scapo gracillimo; umbella 20-flora, ¾ pol. diam.; segmentis (siccis, post anthesin) inflectis, albis; semine unico.—On Feather River, Oroville.

** Sepals acute, equalling the stamens.

A. tribracteatum Torr. Bulb ovate; scape low (3—4′); leaves 2, linear, much longer than scape; umbel 15—20-flowered; spathe of 3 ovate bracts; sepals lanceolate, acute; about equalling the stamens; capsule broadly obovate, 3-lobed, cells 2-seeded.—Hill sides, Duffield's, Sierra Nevada (P. R. R. Rep. iv, 92). *V. s. in herb. Torr.*

A. amplectens Torr. Bulb large; scape low, flexuous; leaves 2, longer than scape, filiform; umbel 3—6-flowered; spathe of two round concave bracts embracing the flowers; sepals oblong, obtuse; capsule 3-lobed, depressed, 6-seeded.—Hill sides, Sonoma, Cal. (Torrey, l. c., *V. s. in herb. Torr.*

*** Sepals acute, stamens exserted.

A. cernuum Roth.? Bulb ovoid-oblong, tapering upwards; leaves 5—8, narrow-linear, erect, shorter than the scape; umbel fastigiate, nodding, finally erect, with a short 2-leaved spathe, and about 20 small roseate flowers; sepals oblong-ovate, acute, shorter than the stamens and slender style; ovary 3-lobed, crowned with a 6-lobed crest!—Dalles of the Columbia and east. 1½ feet. Bulb 1½ in. long, eatable. Flowers 2″ long. Umbel 1′ broad. August.

This plant combines the exserted stamens of *A. cernuum* with the 6-lobed crest of *A. stellatum* Nutt.

§§ Bracts of the spathe 4—6.

A. Sanbornii (n. sp.) Bulbo ovato, albo; foliis ante anthesin evanescentibus (ignotis); scapo gracilente, procero (2—3 ped.), basi longè vaginatis; umb. globosa, confertim 40—100 flora; spatha e bracteis 4 lanceolatis acuminatis; ped. filiformibus, floribus purpureis longioribus; segm. erectis, oblongis, basi gibbosis; interioribus longioribus; stam. et stylo gracillimo exsertis; fil. capillaribus, basi dilatatis; stigm. trifida; caps. trilobata, trisperma, glandibus 3 coronata; spermatibus angulatis, albo-luteis (immaturis).—In collibus umbrosis, Yuba Co. prope Foster's Bar (S. S. Sanborn, Esq.) Aug. Flores 3 lin. longi.

A. maritimum Torr. Bulb globular, corm-like; leaves 3—6, linear, longer (often shorter) than scape; umbel about 10-flowered, fastigiate; spathe of 3—6 narrow bracts, sepals distinct almost to base, oval, with a wide midvein and callous tip, some longer than the stamens; fil. dilated at base; capsule globular, size of a peppercorn, 30-ovuled, perfecting about nine black seeds.—Hills near the sea and bay, Santa Cruz to Benicia and Marin Co. 6—12′. Flowers small, white. April.

A. croceum Torr. Leaves several, linear, as long as the slender scape (1 f.); umbel 9—12-flowered, pedicels spreading, 8—10″; spathe of 4—5 lanceolate, acuminate bracts; sepals oblong, acutish, orange-yellow, 4—5″; stamens shorter, fil. 2-toothed at base; capsule obovate.—Mountains east of San Diego (Mex. Bound. Rep. ii, 218). *V. s. in herb. Torrey.*

HESPEROSCORDIUM, Lindl. (Έσπερος, evening, σκόρδον, garlick.)

Perianth acute at base, articulated to the pedicel; segments 6, distinct, spreading above; stamens six, short, equal, fil. dilated, coherent and perigynous at base; ovary stipitate, many-ovuled; style slender; capsule ovoid, 3-celled, 3-valved; seeds ∞, black.—Corm coated, scape umbelliferous. Involucre of 4 or more bracts. Flowers erect, white.

H. lacteum Lindl. Corm globular, fibrous-coated, brown; leaves 2, linear, shorter than the tall scape; flowers 10—25, shorter than their pedicels; segments cream-white, 1-veined, oblong, obtuse, 6—7″ long; fil. at base broad and connate, forming a corona half the length of the perianth; stipe nearly the length of the capsule.—San Mateo Co. (Mr. Easton), to the Sacramento and Wahlamette. 2 f. (*H. hyacinthinum* Lindl. is the same plant.)

TRITELEIA, Dougl. (Τρίς, thrice, τέλειος, complete.)

Perianth 6-parted, funnel-form, persistent, segments spreading, 1-veined; stamens 6, the 3 inner higher and longer; fil. adherent to the tube, anthers linear-oblong, fixed by the middle; stigmas 3-lobed, style distinct; capsule short-stipitate (in our species), cells 3, about 10-seeded.—Bulbous. Scape umbellate or 1-flowered. Spathe of 2 bracts.

T. grandiflora Lindl., Hook. Leaves linear, glaucous, shorter than the tall (2 f.) scape; spathe equalling the pedicels, which are scarcely as long as the perianth; stipe shorter than the ovary or the style; stigmas 3-lobed; umbel few-flowered.—Plains of the Columbia and Wahlamette. The specimen in Dr. Torrey's herbarium is from the Dalles. I did not meet with it. (V. s.) Flowers white?

SUBERTIA, Kunth. (In honor of Dr. Subert, a German botanist.)

Perianth funnel-form, attenuate at base, half-6-cleft; segments erect, 3-veined in the middle; stamens 6, included, fil. inserted at top of tube; anthers versatile, ovate-lanceolate, obtuse, the 3 inner higher than the 3 outer; ovary oval, longer than its style, 3 to 5 times shorter than its stipe; capsule ovoid, ripening few black seeds from many (15—45) ovules.—Bulbous. Leaves lance-linear. Scape umbellate. Spathe of 3—6 narrow bracts.

S. LAXA Kunth. Bulb globular, fibrous-coated; leaves as long as the scape (12—18′), broadly linear (5—8″); pedicels 10—20, suberect, 2—3′; flowers violet-purple, segments with a triple midvein; stipe 5 or 6 times as long as the ovary (near 1′).—California, middle and northern counties. Bulb as large as a musket ball. Flowers 16″ long. April, May. Very handsome.

S. CROCEA (n. sp.) Foliis 1—2 (v. pluribus?), linearibus, conduplicato-falcatis, erectis, scapo gracilente brevioribus, obtusis; spatha e bracteis 4 subulatis acuminatis, pediculis breviora; floribus 5 v. 6, basi acutis, supra sensim dilatatis (9 lin. longis), segm. æque obtusis, medio vena forti instructis; anth. oblongis, interioribus duplo altioribus; ovario quam stipes crassus triplo breviori; loculis 5-spermis.—Yreka, California. Caulis pedalis. Flores crocei. June.

CALLIPRORA, Lindl. (Καλλος, beauty, πρῴρα, front.)

Perianth of 6 segments united at base into a turbinate tube, spreading above, oblong, 1-veined; stamens 6, perigynous, 3 of them longer, fil. dilated, all tricuspidate, the middle cusp shortest, bearing the anthers; ovary short-stiped; style and stigma undivided; capsule 3-celled, ∞-seeded, seeds black.—Bulbous. Leaves linear-ensiform. Scape umbellate. Spathe of 3 or 4 bracts. Flowers 5—20, yellow. (*Calliproa* Kunth.)

C. LUTEA Lindl.—Hills, Santa Cruz, to Healdsburg and the Sierra Nevada. A handsome plant, 1 f. Bulb globular. Leaves 1—3, as long as the scape, channeled. Segments 6—10″ long, the vein greenish outside. Pedicels 1—2′. Specimens from the Coast Range have a much smaller flower than those from the interior. April, May. Differs from *Subertia* chiefly in its stamens.

BRODIÆA, Smith. (Named for James Brodie, Esq., of Scotland.)

Perianth funnel-bellform, outer segments narrower; stamens 6, inserted into the throat of tube, exserted, outer anthers sterile, petaloid, the inner fertile, erect, fixed by the cleft base (shorter than the segments); ovary fusiform, narrowed to the subsessile base; cells 3, 5—7-ovuled, style equalling the stamens, stigmas 3-fid; capsule substipitate.—Bulbous. Leaves 5, linear, exceeding the scape. Umbel few-flowered. Spathe 2-bracted. Flowers large, violet blue.

B. GRANDIFLORA Sm., *α. macrantha*, Torr. Bulb depressed-globous, fibrous-coated; pedicels stout, divaricate, then erect; flowers 4—8, rarely but 1, the inner segments nearly twice broader than the outer, all spreading above. Sterile stamens usually longer than the fertile, emarginate, yellowish.—Plains and hills, California. 8—18′. Flowers large, varying from 1′ to 2′ in length, on unequal stalks.

B. TORREYI (n. sp.) Bulbo magno, depresso, tunica reticulata instructo; foliis multo elongatis; umb. 5—10 flora, subradicali v. scapo brevissimo, pediculis valde inequalibus; perianthii segm. suberectis, omnibus obtusis; anth. oblongis, castratis elongatis, bifidis.—Swampy places about Oakland, Napa, to Marysville, &c. Leaves 6—10′. Pedicels 3—6′. Flowers $\frac{3}{4}$ inch long. I often saw the live plant, always with the same habits and characters. (*B. grandiflora*, *β. macropoda* Torrey, Bot. Whipp. Rep. 93.)

B. PARVIFLORA Torr. Scape roughish; umbel 15—20-flowered; pedicels shorter than the flower; sterile stamens ovate lanceolate, rather acute, entire; cells of the ovary 6—8-ovuled.—Sierra Nevada. (Torrey, in P. R. R. Rep., ii, 125.) *V. s.*

DICHELOSTEMMA, Kunth. (Δίχηλος, bifid, στέμμα, crown.)

Perianth 6-parted, limb erect or spreading; fil. 6, dilated, perigynous, the 3 outer exserted, petaloid, 2-parted either with or without an anther between the lobes, the 3 inner wholly adnate, antheriferous, rarely appendaged; anthers bifid at each end; ovary 3-celled, cells 3—5-ovuled; seeds few or many, black.—Bulb or corm globous. Leaves linear, flat. Scape tall, wiry, bearing a dense umbel of flowers. Spathe of 3 or 4 broad bracts.

§ Only the three outer filaments appendaged. Flowers violet-blue.

D. congesta Kunth. Leaves 1—2, narrowly linear; scape flexuous, erect (2 f.); flowers subsessile, in a globular umbel, tube tumid at base, contracted above the globular ovary; anthers 3; pedicels roundish; seeds angular, 5 in each cell.—Oregon and N. California, common. Flowers 9″ long, about a dozen in each umbel. March—May. (*Brodiæa congesta*, Smith.)

D. capitata Benth.? Leaves broad-linear, glaucous; scape straight, erect (2 f.) · flowers subsessile, few (5—9), compact, broad at base, not contracted above; anthers 6; pod ovoid, with 9 elliptical seeds.—San Diego to Yreka; often seen with the other, readily distinguished at sight. The seeds are thrice larger than in the preceding. The bulbs of both are largely eaten by the Digger Indians. February—April.

§ *Stropholirion*, Torr. Filaments all appendaged; the lobes of the antheriferous much shorter than those of the sterile.

D. Californica. Leaves long, linear; scape terete, twining on anything in reach, 5—10 f.! Umbels capitate, with 4 or 5 bracts; flowers tubular-bell-form, rose-purple, somewhat constricted above the ovary, articulated to the pedicels; cells 4-ovuled, 1-seeded; seed oblong, black. Common in the foot hills, Marin, Yuba and Placer counties. May. (*Stropholirion californicum*, Torrey, in P. R. R. Rep. iv. 149.)

BREVOORTIA, Wood. Proc. Phila. Ac. N. Sci., June, 1867.
(Dedicated to J. Carson Brevoort, Esq.. Reg. N. Y. Univ.)

Perianth tubular-pyriform (scarlet red), persistent, limb 6-toothed, reflexed, crown erect, of 3 broad truncate scales; stamens 3, fil. adnate, anthers free, exserted, opposite the inner segments (teeth), alternate with the scales of the crown, deeply bifid at base; ovary ovoid, 3-celled; cells 4-ovuled, style slender; capsule?—Bulbous? Leaves long, linear. Scape tall, erect, umbellate. Spathe of 4 bracts. Flowers 8—12, pedicellate, nodding.

B. Ida-Maia Wood. High hills of the Trinity Mountain Range, Shasta Co., Cal. Glabrous, 2—4 f., leaves nearly as long, channeled. Flowers 1′ long, pedicels 1—2′. Singularly beautiful, the tube scarlet, lobes chrome-green, crown yellow, and umbel subtended with 4 purple bracts. May, June.

CHLOROGALUM, Kunth. (Χλωρός, green, γάλα, milk.)

Perianth of recurved-spreading segments; stamens 6, equal, scarcely perigynous, as long as the segments; anthers 2-celled, fixed by the back; ovary free, sessile, cells 3, 2—3-ovuled; style filiform, stigma tricuspidate.—Bulb tunicated. Leaves radical, linear, carinate. Scape branching, with panicled racemes. *Soap Plant.*

C. pomeridianum Kunth.—California, throughout the open country. The bulb is invested with a dense mass of black, hair-like fibres. Leaves broad-linear, recurved, the margins undulate. Scape 2—3 f. high, bracted, with a few spreading branches. Flowers erect, broad, white, in long loose racemes, open only at mid-day in May. The bulb is alkaline and mucilaginous, answering well for soap.

ODONTOSTOMUM, Torr. (Ὀδούς, tooth, στόμα, mouth.)

Perianth salver-form, tube cylindric, limb of 6 equal spreading segments as long as tube; stamens 6, perigynous to top of tube, alternating with as many sterile filaments; style filiform; ovary globous, nearly free, 3-celled, 6-ovuled, capsule 6-seeded.—Bulbous, with broad linear leaves sheathing the divaricately branched stem. Flowers small, racemed, white.

O. Hartwegii Torr.—Foot hills, Yuba, Placer and Sacramento counties. 1—2 f. Radical leaves flat, 3—6′′ wide, 5—7-veined. Segments 5-veined, reflexed after flowering. Stamens and sterile fil. barely exserted. May.

Tribe III.—*SMILACINEÆ.*

Smilacina racemosa Desf.—Common in the Redwood hills, Pejaro to the Russian R., Cal. In no wise different from the eastern plant.

S. stellata Desf.—Santa Cruz, with the last, north to the Columbia River from Astoria to the Dalles. 1 f. Raceme loose, few-flowered. Berries red.

Clintonia Andrewsii Torr. Root fibrous; leaves few, lance-oval, abruptly pointed, sheathing at base, veins running from base to apex; scape taller than the leaves, bracted, bearing 2—4 umbels, the terminal 10—20-flowered, the lateral 2—4-flowered; flowers bell-shaped, yellowish, 8′′ long; segments obtuse; berries 3-celled; cells 8—10-seeded.—Mountain woods near Santa Cruz to the Russian R. A handsome plant, 1—2 f. May.

C. uniflora Kunth. Root tuberous; leaves 2 or 3, lance-oblong, abruptly pointed, margins ciliate; scape not longer than the leaves, bearing one large white flower; segments same shape as the leaves, 10′′ long, stamens shorter; berry obovoid, as large as a pea, 9-seeded, blue.—Northern declivities of Mt. Hood (Mr. Brazee), Cascades to Vancouver! June, July.

Majanthemum bifolium DC. *β. dilatatum.*—From Astoria to the Dalles, north and east. Leaves generally 3, broad-cordate, 3—5′ diameter! Stem 6—10′. Exactly like the eastern plant, except its gigantic size. June. (*Smilacina dilatata*, Nutt.)

Tribe IV.—*UVULARIEÆ.*

Prosartes Hookeri Torr. Stout, leafy, scabrous-puberulent; leaves broadly ovate, acuminate, deeply cordate-amplexicaul; umbels 3—4-flowered, segments spatulate, obtusish; anthers oblong, glabrous; stigma entire.—Santa Cruz to Oakland hills, &c. 2 f. Leaves 2′ broad, strongly veined. Stem and branches reddish, pubescent. Flowers greenish-yellow, 9′′ long. April. (*Uvularia lanuginosa*, *β. major* Hook.)

P. Menziesii Don. Nearly glabrous; leaves lance-oblong or ovate acuminate, sessile, or subcordate-clasping; umbels terminal, 1—3-flowered; flowers bell-shaped, pendulous, as long as their stalks; segments linear-lanceolate, acuminate (6′′), the stamens often longer, and the slender style still longer; berry lemon-shaped, orange-colored, with 6 rounded seeds.—Santa Cruz to the Columbia. Stem 2 f., erect to first branch, then secund. Flowers greenish. May. (*Uvularia* Hook.)

Streptopus amplexifolius DC.—Washington Co., Oregon (Mr. E. Walker). Glabrous. Leaves glaucous beneath. Berries red, oblong, 15—21-seeded.

Notice of some VERTEBRATE REMAINS from Harden Co., Texas.

BY JOSEPH LEIDY, M. D.

The following described fossils were submitted to my examination by Messrs. Geo. N. Lawrence and D. G. Elliot, of New York. They are reported to have been obtained from blue clay and sand, beneath a bed of bitumen, in Harden

Co., Texas, and were donated to the New York Lyceum of Natural H'story by Mr. Robertson. The fossils are mostly thoroughly permeated with bitumen; others slightly.

EQUUS COMPLICATUS.

1. A first superior molar. Length along the inner median column $2\frac{1}{2}$ inches; antero-posterior diameter of the triturating surface 20 lines; transverse diameter, independent of the cementum, $13\frac{1}{2}$ lines. It nearly resembles the specimen represented in fig. 9, pl. xv, of Holmes' Post Pliocene Fossils of South Carolina.

2. A last superior molar, curved to a remarkable degree. Length along the inner median column, less the fang, 2 inches 1 line; antero-posterior diameter of triturating surface independent of cementum 18 lines; transverse diameter do. $10\frac{1}{4}$ lines; length of curve antero-externally 35 lines, postero-externally 16 lines.

3. An upper temporary molar. Length internally $10\frac{1}{2}$ lines; antero-posterior diameter 17 lines; transverse diameter $9\frac{1}{2}$ lines.

4. A fragment of a fourth upper molar.

5. The upper part of the crown of a last lower molar. Antero-posterior diameter $15\frac{1}{2}$ lines; transverse diameter, independent of the cementum, $5\frac{1}{4}$ lines.

6. A fifth inferior molar. Length antero-internally to division of fangs 33 lines; antero-posterior diameter 13 lines; transverse diameter, independent of cementum, 6 lines.

All the above are completely imbued with bitumen, which has penetrated the cementum and dentine throughout.

7. Fragments of a lower jaw, with the first molar tooth. This specimen is only partially impregnated with bitumen. The length of the tooth is 33 lines; the antero-posterior diameter 17 lines; the transverse 7 lines.

MASTODON AMERICANUS. *M. ohioticus* or *M. giganteus* of authors.

A small fragment of a molar.

MEGALONYX VALIDUS, n. s.

A portion of a tooth resembling most in its form the second upper tooth of the *Megalonyx Jeffersoni*, but much larger than in the mature individuals of that species. The transverse diameter is $15\frac{1}{4}$ lines; the antero-posterior $11\frac{1}{2}$ lines. The transverse section is quadrate. The anterior surface is nearly a transverse plane; the posterior surface forms a plane inclining outward; the inner surface is nearly a plane inclining forward; the outer surface forms with those in front and behind a semi-circle. The triturating surface is comparatively slightly concave, and inclines postero-internally. Its anterior border is the most prominent; the posterior being comparatively so little prominent as not strikingly to interfere with the slope of the surface. The specimen is thoroughly impregnated with bitumen.

FELIS (TRUCIFELIS) FATALIS, n. s.

An upper sectorial molar, contained in a small fragment of the jaw, which also includes the socket for a single fanged tubercular tooth. The specimen is thoroughly saturated with bitumen.

The sectorial tooth indicates a feline animal, approaching in size the lion or Bengal tiger. The form of the tooth is nearly like the corresponding one of the latter animals, but the crown is of less width and proportionately longer. The anterior lobe differs from that in the true cats not only in a greater proportionate development, but in its distinct separation in two sub-lobes, of which the anterior is rather more than half the depth of the succeeding one. The measurements of the tooth, in comparison with those in a similar one of a large skull of the Bengal tiger, are as follows:

	Fossil.		Tiger.	
Breadth of crown	$15\frac{3}{4}$	lines.	18	lines.
Depth at anterior lobe	7	"	$7\frac{1}{4}$	"
" at principal cusp	9	"	9	"
" of posterior lobe	$6\frac{1}{2}$	"	7	"
Width at antero-internal abutment	$7\frac{1}{2}$	"	$8\frac{1}{2}$	"

Canis.

An upper lateral incisor, impregnated with bitumen. The tooth is unworn, and is intermediate in size with those of *Canis occidentalis* and *C. latrans.* The unworn crown is $6\frac{1}{4}$ lines long, its antero-posterior diameter $3\frac{1}{2}$ lines; its transverse diameter 3 lines. The compressed fang, broken at the end, has been about 13 lines long; its width is $4\frac{1}{4}$ lines; its thickness $2\frac{3}{4}$ lines.

Undetermined.

An ungual phalanx, apparently of an edentate animal. The end is broken off, and the specimen is thoroughly imbued with bitumen. The length is uncertain, for we cannot determine whether it was blunt or pointed at the end. Supposing it to have been in the former condition, it has been about 28 lines long. The breadth is more than half the length, and is much greater than the depth or thickness. The bone is without sheath, transversely oval in section, $13\frac{1}{2}$ lines wide by 10 lines in depth. The articular facet forms a trochlear concavity, with vertical median elevation, and is directed backward and downward. About one-fourth of the length from the base it expands, and then gradually narrows forward to the apex. The upper surface forms an inclined plane forward, and is convex transversely, and smooth. Its greatest width just back of the middle is 16 lines. The under surface is convex transversely, and slightly so in the length. On each side of this surface, just in advance of base, there is a large vasculo-neural foramen, penetrating to the interior of the bone. A wide but shallow groove curves forward between the foramina, and a deeper one diverges from each laterally and backward. The lateral borders of the ungual expansion are obtuse.

Undetermined.

A bone of uncertain character, but resembling a phalanx. Slightly impregnated with bitumen. It is a curved, four-sided pyramid, with a square plane base, truncated deeply at one angle. A strong boss occupies the incurvature of the bone at the base, and at the side of the truncated angle. The border of the pyramid along the convexity opposite the latter is likewise truncated. The bone in the structure of its surface looks as if it might be of reptilian character, exhibiting everywhere a rather conspicuous vascular porosity. The length of the specimen in the axis is 16 lines, the diameter of the base 11 by $10\frac{1}{2}$ lines.

Emydes.

Small fragments of the carapace and sternum of several species of emydes, thoroughly imbued with bitumen. Most of the fragments are too imperfect to characterize the species, but some of them indicate an animal about the size of the living *Emys scabra* of the southern States, but evidently a different species, as the bones are proportionately much more robust. The fore part of the sternum differs from that of *E. scabra* in the abrupt projection forward of the inner division of the episternals. A pair of these together at the articulation of the hyposternals give a breadth of 43 lines; depth of the episternals to the entosternal 13 lines; projection forward of the part covered by the gular plates 4 lines; greatest thickness $5\frac{1}{2}$ lines. A hyposternal about its middle is 28 lines from before backward; 26 lines in width behind the inguinal notch; and 6 lines where thickest internally. The fore part of a nuchal plate resembles the corresponding portion in *E. scabra*, but is more deeple indented. Its width anteriorly is an inch; the length of its median column $10\frac{1}{2}$ lines; its thickness where greatest 6 lines. The species may be distinguished by the name of

Emys petrolei,

Probably belonging to the subgenus *Trachemys* of Agassiz, like *Emys scabra.*

Indication of an ELOTHERIUM in California.

BY JOSEPH LEIDY, M. D.

ELOTHERIUM SUPERBUS, n. s.

Prof. Whitney recently placed in my hands for examination a tooth of a supposed carnivorous animal, from Douglas Flat. Calaveras Co., California. It was derived from a stratum of the same age as that from which a lower jaw of *Rhinoceros hesperius* was taken. The tooth appears to me to be the right upper lateral incisor of a species of *Elotherium*, perhaps the same as *E. ingens* of the Mauvaises Terres of White River, Dakota, though it would appear to belong to a larger individual than the remains referred to the latter, if not to a yet larger species. The crown of the tooth is conical, compressed from within outwardly, and subacute laterally. The apex is rounded; the base somewhat expanded, and at its fore part produced in a short embracing ridge. The fang is conical and curved. The measurements of the specimen are as follows:

Length of tooth in straight line $29\frac{1}{2}$ lines; length of crown 13 lin.; breadth 9 lin.; thickness $6\frac{1}{2}$ lin.

Notice of some REPTILIAN REMAINS from Nevada.

BY JOSEPH LEIDY, M. D.

Prof. J. D. Whitney has submitted to my inspection some fossils derived from the Triassic rocks, of Star Cañon, Humboldt Co., and from the Toiyabe Range, north-east of Austin, Nevada. The specimens are very imperfect, but nevertheless interesting, and sufficiently characteristic to indicate apparently three distinct reptiles having an affinity to *Ichthyosaurus* and *Eosaurus*, nor am I prepared to prove that they do not belong to one of these.

The fossils have been and are yet partially imbedded in a dark bluish siliceous limestone, and the same material has so completely infiltrated the bones that they almost appear like modified portions of the same rock.

One of the specimens consists of a mass of rock containing two vertebræ and parts of two others in series. The same rock includes two shells, which appear to be *Ammonites Blakei*, Gabb, and *Posodonomya stella*, Gabb. The specimen is from New Pass, in the Toiyabe Range, north-east of Austin. The body of the vertebræ is deeply biconcave, as in *Ichthyosaurus*. The length is considerably less than the breadth. The under side is plane fore and aft, but the margins are slightly prominent and bevelled. The sides are slightly concave, and provided with a short and robust process for the head of a rib. The neural arch with its spine, visible in one vertebra along the broken margin of the specimen, rises above the body about one and a half times its depth, and its abutment exhibits the remains of another articular process for the rib. The neural canal is triangular. The measurements of the vertebræ, partially estimated, are as follows:

Length of body inferiorly	11 lines.
Depth of body	16 "
Width	16 "
" including costal processes	21 "
Height of neural arch, including spine from upper part of body, obliquely	28 "
Height of neural canal	8 "

A second specimen from Star Cañon, Humboldt Co., consists of a series of eight vertebræ, partially included and held together in the matrix, and much weather-worn where they have been exposed. The vertebræ may be part of the caudal series of the same animal as the above, but the matter is uncertain. The eight vertebræ together have a length of 58 lines, making about $7\frac{1}{4}$ lines for each.

A third specimen from the Toiyabe Range, on the Reese River, north-east of Austin, consists of the isolated body of a vertebra, somewhat distorted, ground off at one of the articular faces, and less infiltrated with the rocky matrix than the others. It appears to have corresponded in proportions with those of the series last noticed. It is biconcave, moderately concave at the sides, nearly plane below, presents the remains of two short oblong articular processes for ribs near the position of the neural arch, the sutural impressions of which are visible above. The length has been about 8 lines, the breadth about 16 lines. The neural canal about 2 lines wide.

The very imperfect condition of the specimens renders me unable to say more about them, nor is it certain that they all belong to the same animal, but for the present I propose to consider them so, under the name of Cymbospondylus piscosus.

Of the remaining specimens, three consist of the greater portion of three vertebral bodies, which belonged in series and have been broken apart. These are labelled Humboldt, Nevada. They apparently indicate a much larger species of the same genus as the former, the vertebral body having the same form. The sides of the articular funnels are convex outwardly from the centre, which deepen more rapidly at the inner third of the surface. One specimen retains the neural arch without its spine, and a short, robust, costal process, extending from near the bottom of the arch almost half the depth of the body. A second vertebra is singularly distorted, apparently as if the bone had been in a plastic condition. The measurements of these vertebræ, partially estimated, are as follows:

Length inferiorly	17 to 18 lines.
Depth of body	44 "
Breadth "	44 "
Depth of costal process	21 "
Projection of costal process	4 "

For this species I propose the name of Cymbospondylus petrinus.

Another specimen, consisting of a mutilated vertebral body from Star Cañon, Humboldt County, indicates an Enaliosaurian, apparently not only differing from either of the former, but probably belonging to a different genus. The specimen is broken away at the top and at one side, is also somewhat mutilated on the opposite side, and appears considerably eroded on one articular face. The body is deeply biconcave, as in *Ichthyosaurus*, but proportionately much longer in relation with the breadth. The funnel-like surfaces are convex outwardly from the centre, and deepen more rapidly at the inner third. The sides and under part of the body are slightly concave fore and aft, and defined by acute borders. The under part exhibits a square depressed appearance from the presence of four angular chevron processes, associated fore and aft by subangular ridges. The estimated size of this specimen is as follows: Length of the body inferiorly $2\frac{1}{4}$ inches; depth $4\frac{1}{2}$ inches; breadth about 3 inches.

For this animal I propose the name of Chonespondylus grandis.

Notice of some VERTEBRATE REMAINS from the West Indian Islands.

BY JOSEPH LEIDY, M. D.

Some time since Prof. Felipe Poey, of Havana, sent to me several fossils, together with a copy of a pamphlet entitled "De la Existencia de grandes Mamiferos Fosiles en la Isla de Cuba. Par D. M. F. de Castro. Habana, 1865."

The fossils consist of the vertebra of a crocodile and part of a costal plate of a turtle, which were found with other bones, together with the lower jaw of a giant sloth, at Ciego-Montero, Cienfuegos, Cuba.

The reptilian fossils are as follows:

CROCODILUS PRISTINUS, n. s.

A posterior dorsal vertebra of mature age, but without its neural arch, except the greater portion of one abutment. The body is slightly shorter, and absolutely very much broader and moderately deeper than in the corresponding vertebra of the Mississippi alligator. It also more rapidly narrows posteriorly, but proportionately presents about the same degree of concavity from before backward at the sides and beneath, where it is also in like manner smooth. The anterior articular surface is of considerably greater breadth than height, so as to present a transverse ovoidal outline. The measurements of the specimen are as follows: Length in the axis 23 lines; inferiorly 19 lines. Height anteriorly 19 lines; breadth 24 lines. Estimated height posteriorly 17 lines; breadth 21 lines. Thickness of neural abutment anteriorly 12 lines. I have not the means of comparing the fossil with vertebræ of either species of the living crocodiles of Cuba, so that I cannot say whether it belongs to one of them or not. It is too large to belong to *C. rhombifer*, according to the dimensions given by Dumeril, but would perhaps accord with *C. acutus*. As an associate with a *Megalonyx*, it is not unlikely that it belongs to an extinct species, for which the name leading this article is proposed.

TESTUDO CUBENSIS, n. s.

Indicated by a portion of what I suppose to be the first costal plate of the right side. It is marked by the lateral borders of the first and second vertebral scutes and their transverse separation. Along the former borders the plate is 51 lines, and along the latter separation 16 lines. The articular border with the first vertebral plate is 30 lines; that with the second vertebral plate 14 lines. The articular border from the first vertebral plate to the lateral groove defining the first vertebral scute is convex forward and inward, and 14 lines in a direct line. A strong costal process projects from the under part of the plate nearly parallel with its length. The surfaces corresponding with the vertebral scutes are somewhat depressed, and generally everywhere are nearly smooth, or without markings so conspicuous as to affect the investing scutes. The greatest thickness of the bone is where it articulated with the first and second marginal plates, measuring from $3\frac{1}{2}$ to $4\frac{1}{2}$ lines; and where thinnest it measures only one line.

No living *Testudo*, I believe, at present inhabits Cuba, and the fossil probably indicates a species cotemporary with the *Megalonyx*.

The pamphlet above mentioned contains a notice of remains of the horse, hippopotamus, and of a giant sloth, found in Cuba.

The remains of the horse appear not to differ from the corresponding parts of the recent animal, and it is even doubtful if they are to be considered indigenous fossils.

The remains of hippopotamus, consisting of isolated canines, probably also belong to the recent animal. An inferior canine, described and figured by De Castro, certainly presents nothing peculiar. Formerly dentists employed the canines of the hippopotamus for the construction of artificial teeth, but since the introduction of porcelain teeth they have been thrown aside. Occasionally such specimens have been brought to me as supposed fossils, and perhaps the Cuba specimens are of the same character.

The most interesting fossil described by De Castro consists of the greater part of a lower jaw of a giant sloth, which was found in association with a number of reptilian bones, of which those above described are specimens, at Ciego Montero, Cienfuegos. The figures accompanying the description, though drawn in unfavorable positions for satisfactory comparison, nevertheless clearly indicate a lower jaw of nearly the same form, and teeth holding the same relative position as in *Megalonyx*. As in this genus the anterior large caniniform molar is widely separated from the posterior three small molars, which differ from those of *Megalonyx Jeffersonii* only specifically. From the dimensions given, the jaw belonged to a smaller animal than the latter. The caniniform molar differs remarkably from that of *M. Jeffersonii* and *M. dissimilis*, as is also the case compared with that of *Lestodon armatus* and *L. myloides* of Buenos Ayres. In transverse section it is reniform or crescentic with blunt poles, and the biting extremity appears to have been worn off in the same manner as the incisors of a Rodent, to which, indeed, the jaw appears first to have been supposed to belong. The species may be named MEGALONYX RODENS, or, if the peculiarities of the caniniform molar be regarded generically distinct from those of *Megalonyx* and *Lestodon*, it may be named MEGALOCNUS RODENS.

EMYS SOMBRERENSIS, n. s.

The bones of extinct species of turtle are not unfrequently found in the so-called Sombrero guano, Sombrerite or Ossite, a material rich in phosphate of lime, largely mined in the island of Sombrero, W. I., and used in the preparation of a fertilizer for agricultural purposes. In a mass of this material presented to the museum of the Academy (see Proc. 1859, 111), the posterior part of the plastron of a species of *Emys*, or perhaps *Testudo*, is perceived, for which the above name is proposed. The specimen consists of both xiphisternals and the greater portion of both hyposternals, articulated in natural juxtaposition. Other fragments of the plastron and carapace, together with a portion of a thigh bone, are also contained in the mass. The specimen indicates the sternum to have approximated a foot in length; and the breadth at the lateral sutures of the hyposternals has been about 7½ inches. The under surface of the sternum is flat and smooth; and laterally it curves but slightly upward. The posterior sternal notch is two-thirds as deep as the width, and almost forms an equilateral triangle. The postero-lateral border from the inguinal notch to the rounded triangular ends of the xiphisternals, is bow-like, or presents two concavities with an intervening convexity. The caudal scutes are small, reaching slightly beyond the bottom of the sternal notch. The femoral scutes are on a level with the inguinal notches. Estimated length of hyposternals in the median suture 35 lines; breadth 45 lines. Length of xiphisternals in median suture 17 lines; greatest length about middle 25 lines; breadth along anterior suture 28 lines. Length of caudal scutes internally 13 lines; externally 10 lines. Length of femoral scute internally 25 lines. The bones present about the ordinary proportion of thickness observed in emydes.

July 7th, 1868.

DR. BRIDGES in the Chair.

Twenty-one members present.

The following papers were presented for publication:

"Notice of some remains of Horses." By Joseph Leidy, M.D.

"Notice of some extinct Cetaceans." By Joseph Leidy, M.D.

"Mitchella repens; a Diœcious plant." By Thomas Meehan.

July 14th.

The President, DR. HAYS, in the Chair.

Nineteen members present.

The following papers were presented for publication:

"Second contribution to the history of the Vertebrata of the Miocene period of the United States." By Edw. D. Cope.

"Remarks on Conosaurus." By Joseph Leidy, M.D.

"Remarks on a jaw fragment of Megalosaurus." Jos. Leidy, M.D.

E. D. Cope exhibited the vertebra of an extinct reptile, from the middle green sand bed of New Jersey; which possessed the peculiar articular structure known as the zygantrum and zygosphen. He said the form was in some degree like that of certain modern terrestrial genera of Iguanidæ, as the genus Euphryne, Baird, but it appeared to have some affinity to Macrosaurus, Owen, in form. The animals, if similar in proportions to the Iguanæ, would have been some twelve feet in length. It was called CLIDASTES IGUANAVUS.

A Mosasauroid reptile was indicated also by a single vertebra from Medford, N. J., also from the middle bed. It was distinguished from other forms of the family by its compressed elevated form. It was assigned to a species named NECTOPORTHEUS VALIDUS.

The structure of the vertebral column in Elasmosaurus was pointed out. It was stated to possess apparently no zygapophyses throughout its whole length, but in place of these, the zygosphen and zygantrum articulation. The articulations of the vertebræ were therefore the reverse in respect to direction of their surfaces from the usual form among vertebrata. In fact the structure of the genus was shown to be entirely new and peculiar among vertebrated animals. The genus Cimoliasaurus, Leidy, was stated to exhibit the same structure, and required that the vertebræ should be reversed in order to read their connections correctly.

Thomas Meehan said he had proposed to himself to contribute a paper to the American Academy of Science which meets next month in Chicago, on the leaves of Coniferæ; but some friends here acquainted with his intention, and interested in the facts, were desirous he should explain to them some of the leading points, which he would with pleasure do.

His chief position was that what are usually considered the leaves of Coniferæ are but a part, and frequently the least important part of the true leaves, which are either mostly adherent or mostly free according to the vigor of the branch or individual plant, and not according to any specifically constitutional character; and that a recognition of this fact is of great importance in determining the limits of genera, species and varieties of the Order. He exhibited specimens of the *Larix Europæa*, pointing out that it had two classes of leaves, the one entirely free, the other mostly adnate to the stems. The adnate leaves were on the elongated shoots, the free leaves on the arrested shoots or verticills; on the elongated shoots the leaves also had a power of elongation, and produced the green awl-shaped points we commonly called leaves. On the arrested shoots or spurs, the leaves had no power of elongation. They were obtuse, rather spatulate, just the same as the adnate portion—the true leaves—on the stem. The theory he deduced from this was that *adnation was a characteristic of vigor; free leaves a condition of weakness or arrested growth*. This explained the polymorphous character of many Coniferæ. The rule operated through many genera. He exhibited strong branches of *Cryptomeria japonica*, on which the leaves were united for four-fifths their length, and weaker ones on which four-fifths were free, &c. The same occurs on *Juniperus virginiana*, *Juniperus communis*, *Thuja orientalis*, *T. occidentalis*, and other species. Wherever the shoots were delicate, either constitutionally or by growing in the interior of the plant and deprived of their due share of light, the leaves were free; wherever the contrary existed, and the shoots were vigorous, adnation in a greater or less degree prevailed. In many species this polymorphous condition could be produced at will, by weakening the plant. Cuttings of *Thujopsis borealis* made from branches with adnate leaves, would throw out shoots with free leaves until they were very well rooted and able to throw out vigorous shoots.

A test of vigor was the power to branch. Only on vigorous maturity did the branching age of trees commence. Arbor vitæs, when mature, pushed out branches from the axils of every other pair of leaves. This gave them their fan-like appearance. When young they branched little, and this stage was always marked by more or less free leaves. *Thuja ericoides* of gardens, with its heath-like foliage, was a weakly constituted form, which retained its childhood foliage, and had little disposition to branch. *Thuja meldensis* of Lindley, which from its peculiar appearance that learned author supposed to be a hybrid between the red cedar and Chinese arbor vitæ, was a form of intermediate vigor, branching moderately, and leaves intermediately adnate. *Retinispora ericoides* of Zuccarini, was also a weak form with free leaves, the well developed form of which he had had no opportunity to trace with certainty. *Taxodium distichum* Richard, and *Glyptostrobus sinensis* Endl., were no doubt the same thing. He showed, by the vigorous branching character of the latter, the necessity for the arrested foliation it presented, and exhibited specimens of vigorous (more branching) *Taxodium distichum* in which the leaves were abbreviated and twisted around the stem, exactly as in *Glyptostrobus*, except that the free parts were rather longer. This form did not branch quite as much as the typical *Glyptostrobus*, but more so than in the typical *Taxodium*.

He remarked that the two genera *Pinus* and *Sciodopitys* had their true leaves adpressed almost entirely to their branches, and illustrated this by specimens of *Pinus austriaca*. Instead, however, of these genera developing green free points on the apices, they pushed out rather abortive branches from the *axils* of the true leaves. The fasicles of leaves on these plants were not true leaves, but were intimately connected with the axial system of the plants. The adpressed true leaves on the pine were annual, although as dead epidermis they remained often on the bark until the regular excorticating period arrived; but these so-called leaves, or rather metamorphosed branchlets, remained often several years. He had known some remain eight years. Their connection with the axial system could be seen by raising the bark of a three or four year old branch on the Austrian pine.

Mr. Gabb made some remarks about Kitchen Middens, in the vicinity of San Francisco and on the shores of San Francisco Bay, his attention having been called to the similarity between them and those observed by Dr. Leidy, near Cape Henlopen. He also mentioned a curious circumstance for which he had been unable to account. In various places on the coast of both Upper and Lower California, he had observed shells, often of the heavier species, scattered over the surface in great profusion, and occasionally to a distance of several miles from the beach. They were evidently of very modern origin, being strewn on the surface of the soil, but whether they had been carried there by man or birds, he had never been able to discover.

Dr. Wm. L. Wells made some observations on the mode of scattering the spores of the *Polypodium vulgare*. Under the microscope the sporangium could be seen to open at a point near its stem; and the opening grew very slowly larger, until the continuation of the stem which previously encircled the sporangium was nearly straight. It then suddenly sprang shut with a jerk, which scattered the spores in every direction, and which usually sent the sporangium itself out of focus. In the cases in which it was not thrown entirely out of focus, the same operation could be seen to be repeated two or three times. In no case were any spores scattered during the opening, which always took place very slowly.

July 21st.

The President, Dr. Hays, in the Chair.

Fourteen members present.

The following paper was presented for publication:

"On the Crocodilian genus Perosuchus." By Edw. D. Cope.

Mr. Gabb made some remarks on a small lot of fossils submitted to him by Prof. Orton. The fossils are small, and all belong to undescribed species. They are of unusual interest, being the first fossils, so far as he was aware, ever found in the immense clay deposits of the Amazon Valley—the Tabatingu Clay. The fossils indicate a marine origin for this clay, all of the genera being essentially salt-water forms. They were found by Prof. Orton in a bluff showing a fine section of about fifty feet in height, at the town of Pebas, on the Amazon River, two miles above where it joins the Maranon.

July 28th.

DR. J. GIBBONS HUNT in the Chair.

Fifteen members present.

The following gentlemen were elected members: Geo. Roberts, M.D., Mr. Levi Taylor.

The following were elected correspondents: S. Spencer Cobbold, M.D., of London, W. Kitchen Parker, of London, Rev. Samuel Haughton, of Dublin, Alphonse Milne Edwards, of Paris, Wm. T. Brigham, of Boston.

On favorable reports of the committees, the following papers were ordered to be printed:

MITCHELLA REPENS, L., a diœcious plant.

BY THOMAS MEEHAN.

A few weeks ago I had the honor of pointing out to the members of the Academy that *Epigæa repens* was a diœcious plant. I have now to report a like discovery in *Mitchella repens.*

In the case of *Epigæa* I had to indicate the polymorphism accompanying the divisions of the sexes, as part of the discovery; in the present instance Dr. Asa Gray is before me in noting the distinct appearances; the originality of my own observation lies merely in giving the meaning of the facts already recorded. In the last (5th) edition of Gray's Manual, speaking of *Mitchella*, the author says, "Flowers occasionally 3—6, merous, always dimorphous, all those of some individuals having exserted stamens and included stigmas,—of others included stamens and exserted style." Although this statement expresses the appearance, it is not strictly accurate; for the pistil in the one case is not perfect, and in the other the anthers are mere rudiments, without a trace of pollen in any that I have examined. The two forms are truly male and female plants.

In the female plant the pistil, with its well-developed stigma, projects one-eighth of an inch beyond the throat of the corolla. The small rudimentary anthers are sessile, and hidden among the coarse down of the corolla tube, so as not to be seen without dissection.

In the male plant it is the rudimentary pistil which is confined in the villous tube, far out of reach of pollen influence, if even it were perfectly developed. On the other hand, the anthers are borne on filaments which are free from the corolla for one-eighth of an inch, and projecting that much beyond the corolla throat.

In the case of *Epigæa* I had to record many variations in the form and proportions of the floral parts. *Mitchella* is as remarkable for uniformity; except that the calyx teeth in the male are coarser than in the female, there is little variation from one type. Dr. Gray observes that the lobes of the corolla vary from three to four, five, and six. I may add that five-lobed corollas are common, and these are usually accompanied by five anthers.

The number of male plants is about equal to the female; occasionally plants of the separate sexes intermix. I, and probably others, have often noticed in the fall some patches bearing abundantly, other patches without a berry. The facts I now offer afford the solution.

In reference to *Mitchella*, it may not be out of place to correct an error in Lindley's "Vegetable Kingdom." The learned author includes in his natural order Cinchonaceæ *Mitchella*, *Cephalanthus*, *Diodia*, *Oldenlandia* and *Spermacoce*,—all high northern plants; and yet, when speaking of the geography of the order, writes that "the most northern species in America is *Pinckneya pubens*, inhabiting the Southern States of North America."

Second contribution to the History of the Vertebrata of the Miocene period of the United States.

BY E. D. COPE.

A visit to the Miocene region of the western shore of Maryland, has explained to the writer more clearly the stratigraphical position of the vertebrate fossils described in this and preceding essays on the subject.

The miocene deposit which contains the fossils, consists of a dark sandy clay, varying from a leaden to a blackish color, through which water does not penetrate. Its upper horizon may be traced along the high shores and cliffs of the Chesapeake by the line of trickling springs which follow its upper surface. The bottom I have not seen, and cannot give its depth, but a great bed of shells occurs at from fourteen to twenty-two feet below its upper horizon. This consists of, first, two separate shallow strata of shells, and about four feet below the upper, a heavy bed at the depth mentioned. The lesser beds vary in amount, being sometimes wanting.

The streams of the country either flow on or cut the shell beds, and display their washings, as teeth of sharks, cetaceans, etc. The bones generally occur at or near the level of the upper line of shells. The remains of the large whale, the Eschrichtius cephalus mihi, lay across the bed of a small run and penetrate the bank, where I saw the remainder of its vomer, of which I have the half; with numerous other parts of the cranium added since the description of the species, it was dug out by my energetic friend Jas T. Thomas, whose evidence as to the pertinence of the various pieces described to the same animal is conclusive. It is, if need be, confirmed by the white color and porous texture of them all, a character not noticeable in other large whale remains procured by him. Apparently pertaining to a genus known as fossil only from the European drift, it becomes important to be sure of its Miocene origin. This must be admitted; it lay together as originally deposited, just below the upper shell line, and did not extend so far down as the great bed, from 10 to 18 feet below the top of the blue loam. The upper line of the latter has been varied, inland, by the various operations of erosion, etc. In some places it forms the bottom of vallies, which are excavated almost to the shell line. In such a situation, about 3½ feet above the great shell bed, and a few inches below the surface on the side of a creek, the bones of Galera and Dicotyles occurred.

BASILOSAURIDÆ.

CETOPHIS Cope.

This genus rests upon the evidence furnished by caudal vertebræ in the collection. They present an approximation to Basilosaurus in the great thickness of their epiphyses. In the more elongate vertebra each epiphysis will measure the third the length of the centrum deprived of them; in the less elongate, they measure one-half the same; in the shortest, more than half the remaining centrum. One extremity of the vertebra is flat, the other strongly convex, and none have any trace of diapophyses. The neural arches have been partly broken away, but have been similar to those of other genera, while the groove that marks the inferior aspect of caudal vertebræ is normal. In two vertebræ, the longest and shortest, the foramina which usually pierce the sides of the centra vertically, issue below, within the basal groove and above, below and outside the basis of the neurapophysis. In another specimen the foramen opens outside the inferior sulcus, and in one there is no foramen at all. These structural features indicate a genus of general peculiarity, and perhaps allied to Basilosaurus. There may be some question as to whether two species are not represented among the vertebræ.

CETOPHIS HETEROCLITUS Cope.

The four specimens may represent a proximal, a median, and a distal caudal of one individual, and a median caudal of another. They were not adult, as the epiphyses are entirely separable. The longer or proximal caudal is sub-hexagonal in section, the median depressed, and the smallest round in section. The larger median is nearly round in section. The epiphysis instead of retreating before a process of the centrum opposite the four apophyses, as in Ixacanthus, advances on the centrum at these points. The inferior groove of the centrum is deep on the first and shallower on the succeeding; obsolete on the last. The neural canal about as large on the proximal as in anterior caudals generally.

	In.	Lin.
Length longest	3	3·8
Height flat articular face	2	1
Width do. do.	1	11·
Length median (smaller)	2	6.3
" without epiphyses	1	1·5
Height flat face	1	9
Width "	1	9·2
Length median (larger)	3	1·2
Width flat face	2	5
Length smallest	2	1
" without epiphyses		11·
Height flat extremity	1	10·5
Width do. do.	1	11·

From Charles county, Maryland. From Jas. T. Thomas, Mus. Academy.

The convex articulation of the vertebræ would suggest a greater flexibility of the column in this part than is usual among Cetacea, but more as in cervical vertebræ of long-necked mammals, and in reptiles. The absence of diapophyses would confirm such an indication. Were it not for the inferior groove the longer vertebræ above described might be taken for a lumbar, and it may be such, as in the Zarhachis f l a g e l l a t o r a similar form coexists with the usual form of diapophysis of that part of the column. There is probably some distant affinity between the two genera.

With respect to the genus Basilosaurus, it may be noted that the *Polyptychodon interruptus* of Emmons, must be regarded as established on one of its canines. Whether the species be the D. c e t o i d e s must be left for their examination. A fine specimen is in the Museum of the Mount Holly Lyceum of Natural History.

In the description of the Cynorca p r o t e r v a (in Proceed. Acad. 1867,) misled by the extraordinary resemblance to Giebel's plate quoted, I unfortunately mingled with its molar and premolar teeth, the canine of small Dicotyles. This point, suggested to me by Leidy, I have no doubt is the case. It will be necessary therefore to add the following details of character of the characteristic molar and premolar, which I described too briefly (p. 151): "Molar with two roots. Premolars with short conic crowns. Premolars compressed, cutting. Roots of premolars compressed." (P. 152): "Two teeth having crowns similarly though rather more symmetrically formed, I suspect to have occupied that position," i. e. "between molars and premolars."

The premolar first mentioned is about ·8 in length, the crown slightly striate. The anterior molar has two roots, which are united some distance below the crown. The crown exhibits no denticles, and is not more elevated than the antero-posterior diameter of its base. This tooth, as well as the other, is of small size, and indicates the smallest species of the family.

The Pontogeneus priscus Leidy, which I referred, in accordance with a printed suggestion of Leidy's, to the *Zeuglodon pygmæus* Müller, on examination proves to be a Delphinoid. The species of Müller is not only generically distinct from Basilosaurus, but from Doryodon also, to which I referred it,* if it be regarded as established on the cranium figured by Gibbes in the Journal of the Academy.

DELPHINIDÆ.

Among the vertebræ of the species of this family collected by Jas. H. Thomas in the Miocene marls of Charles county, Maryland, may be recognized those of five genera, as follows:

The caudal vertebræ broader than long; lumbars, sacrals and caudals nearly similar; diapophyses of lumbars and caudals flat dilated, the latter with vertical foramen........ DELPHINUS.

The caudals longer than broad, slender; diapophyses broad, of caudals perforate........ DELPHINAPTERUS.

The caudal vertebræ longer than broad, lumbars and caudals with flat diapophyses which are not perforate........ ZARHACHIS.

The lumbars, dorsals, and caudals elongate, narrower than long; the diapophyses of some of the lumbars and of the caudals narrow and spinous, and not perforate; epiphysial face plane........ PRISCODELPHINUS.

The lumbars and dorsals shorter, the diapophyses of both posterior lumbars and caudals narrow and subcylindric, not perforate; epiphysial face grasping the epiphysis by four processes, one opposite each neur- and one opposite each diapophysis........ IXACANTHUS.

We find a serial relation among the Dolphins of this period, and exemplified in the characters of the above genera. In Tretosphys the diapophyses are all flat as in Dolphins, generally many of the caudals perforate, with a vertical foramen at the base as in them. This is succeeded by a genus in which the blood vessel which in the former passes through this foramen runs round the front of the base of the diapophysis. In the next form some of those of the caudal vertebræ are narrower, and the posterior subcylindric and spine-like; in the last genus of the series the diapophyses of all the caudals and many of the lumbars have the same spinous form. There is also a relation of a similar kind in the forms of the beak of Miocene Dolphins. All are elongate, some very narrow and prolonged, and some a cylindric beak only toothed at the base, (Rhabdosteus Cope). It is an interesting object of inquiry to determine whether the relation of structure of the processes in any way coincides with that seen in the muzzle.

A point to be noticed in our Miocene Dolphins, as compared with the Inia, Beluga, Delphinus and Phocæna of the present period, is the universally increased length of the vertebræ of the posterior part of the vertebral column. Those species named here Delphinapterus resemble in their dorsal vertebræ the Belugas, but the caudals of some, instead of being shortened, as in the latter, do not diminish in length. This points to a more slender form, and with the narrowed diapophyses and increasing thickness of the epiphyses constitutes an approach to the Basilosaurus type.

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* Proc. Acad. 1867, 155.

IXACANTHUS Cope.

This genus is similar to the next in the cylindric spinous character of the diapophyses af the caudal and lumbosacral vertebræ, but differs from it and all other Delphinidæ with which I am acquainted in the manner of attachment of the epiphyses of the vertebræ. Instead of being nearly plane and thin discs, they are furnished with two oblique faces above, which are capped by a projecting roof formed by the floor of the neural canal, while their central portion forms a knob which fits a corresponding shallow pit of the centrum.

IXACANTHUS CŒLOSPONDYLUS Cope.

Extremities of centra deeply concave when epiphyses are removed; length of vertebræ less than breadth.

	In.	Lin.
Length centrum lumbar	2	4·5
Width " "	2	6·5
Elevation " "	2	4
Width neural canal on dorsal	1	
" " " on lumbar		4½
Length of caudal vert	2	6
Transverse diameter	2	3
Width diapophysis at base		6
Lumbar,—elevation of body and spine to anterior zygapophysis	4	9½

We have of this species three dorsals, nine lumbo-sacrals and one caudal, one only of the lumbo-sacrals exhibits the spine-like diapophysis characteristic of the genus. One of the caudals belongs to an entirely adult animal. The dorsals are rather constricted, and rounded below; the lumbo-sacrals have a strong median keel, except in one near the canal series, when it again becomes rounded below.

I first received this species from my kind friend Oliver Norris Bryan, of Charles county, Md. Jas. T. Thoms has also discovered various portions of it.

PRISCODELPHINUS Leidy.

Posterior lumbars and caudals spinous, dorsals with flat diapophyses.

The prominent character of the genus is seen in the lumbo-sacral and caudal vertebræ, whose diapophyses are very narrow at the base, and soon become cylindrical and slender, terminating in an obtuse point. The general form of the vertebræ is like those of Delphinus, but with the exception above noted, that the caudal vertebræ, instead of being shorter than the dorsals, are really longer, till we approach the posterior portions of the series. The largest of the typical species will not exceed seven feet in length, while the aberrant P. flagellator has been perhaps twelve.

In the P. spinosus Cope, the spinous form of the diapophyses is exhibited among the longer ones of the lumbar series considerably in advance of the caudals. In P. atropius Cope, and P. conradi Leidy, I have seen it on the most posterior lumbars only, though it may occur further anteriorly, and several such have the diapophyses much narrowed. I have not seen it in the P. harlani Leidy, but it probably exists there, as the species is very near the P. conradi.

PRISCODELPHINUS SPINOSUS Cope.

This species is represented by two cervical, three dorsal and eight lumbo-sacral vertebræ; they are about as broad as long, with articular faces transversely oval. As they belong to more than one individual they vary a little more than is to be expected in a single series. They differ of course greatly in the size of the neural canal, with the position in the column. That with the smallest, (the posterior) exhibits no zygapophyses or their rudiments. General form depressed; sides of centrum nearly plane to a well-marked obtuse median keel.

		In.	Lin.
Length centrum lumbar		1	9
Width articular face		1	7·5
Height		1	6
Length diapophysis		2	
Width neural canal	posterior lumbar.		3
Whole height of	posterior lumbar.	3	8
Length diapophysis of	posterior lumbar.	1	6·5

This is the type of genus, for in it the peculiar form of the diapophyses extends much further forward on the series of vertebræ than in any other.

Priscodelphinus atropius Cope.

This species is based upon three cervicals, and three dorsals of one, two lumbars and one caudal of a second individual, one lumbar and one caudal of another, and three lumbars of a fourth. The diapophysis of the caudal is short and spine-like, as in the last genus, and the last lumbar has had a nearly similar process. The centra of all are very slightly depressed and constricted medially. The dorsals are broadly rounded in section without inferior carina; on the last lumbar the lateral face below becomes, as in other species, slightly concave.

This species differs from the P. harlani in that the dorsal vertebræ are not so depressed, are stouter, and have not the median inferior keel seen in it.

	In.	Lin.
Length of a dorsal (No. 1)	2	2
Width articular face	1	11·5
Depth " "	1	7
Height neural canal (No. 2)		9·7
Length diapophysis (No. 1)	1	4

Priscodelphinus harlani Leidy.

Proceed. Acad. 1851, 327.

A few vertebræ of this species occur in the collection.

Priscodelphinus conradi Cope.

Delphinus conradi Leidy, Proc. Academy, 1853, 35, Cope, l. c. 1867, 144.

This appears to be an abundant species of our Miocene beds. We have ten lumbars and one caudal vertebræ. Its affinities are apparently nearer the last-mentioned species than any other.

Priscodelphinus stenus Cope.

This species is represented by two vertebræ, but quite characteristic ones of the lumbar series. They indicate both the smallest and the most slender species of the genus. A section of the vertebra would have an almost exact pentagonal form, though the articular surfaces are subround, and, what occurs in no other species, a little deeper than wide. The neural arch preserved is elevated and possesses a weak pair of zygapophyses. The bases of the broken diapophyses indicate that they are very wide. The lower face of the centrum has a strong median longitudinal angle, stronger than in any species, and not prolonged into a thin keel as in D. hawkinsii. The planes of the centrum are mostly straight.

	In.	Lin.
Length centrum	1	7·2
Height	1	0·5
Width	1	0·5
" neural canal		5·8
" basis diapophysis		10
Height neural canal		6
" zygapophysis		8·2

ZARHACHIS Cope.

This genus is established on vertebræ which bear a general resemblance to those of Priscodelphinus, but differ in the essential point of having flat and broad diapophyses of the caudals. It is therefore intermediate between that genus and Delphinapterus. The posterior of the caudals in our museum exhibits a narrowing of the diapophyses, as certain of the lumbars do in Priscodelphinus.

ZARHACHIS FLAGELLATOR Cope.

This species is represented by only two lumbar and two caudal vertebræ, which belonged to at least three different individuals, none of them adult. Neither is any one entirely perfect, but they indicate a very distinct species, by clear characteristics. All these vertebræ are of greater length as compared to the diameter than in any other cetacean known by me except the great Basilosaurus. The lumbars, when compared with those of T. lacertosus, differ in their broadly obtuse median line, which offers distinct trace of the two keels. An anterior caudal either exhibits unusually broad diapophyses, which are directed downwards, or else is a lumbar with two keels, and a median groove below, which is not seen in any other species. The caudals exceed in length those of any other species. One of these, from a large individual, resembles that of P. atropius in the narrow basis of the diapophysis, which is probably narrow, and not perforate. The length of the vertebræ is nearly double the vertical depth of the articular faces. The diapophysis is nearly median; the basis of each neurapophysis is one-half the length of the centrum, and median.

	In.	Lin.
Length lumbar (epiphyses hypothetical)	3	6 5
Depth	2	2
Width	2	3
" neural canal	2	8
Length caudal (one epiphysis supplied)	3	10·5
Depth "	2	4
Distance between inferior keels		10·5
Width basis diapophysis		10·5

DELPHINAPTERUS Less.

DELPHINAPTERUS RUSCHENBERGERI Cope.

This species is represented by two vertebræ, a lumbar and a caudal, which indicate an animal of about the same or a little larger size than the Priscodelphinus stenus. They are also of a slender form, more so than in any species of the last genus. What distinguishes it generically, is that instead of the slender diapophyses of the caudal it has the broad ones of the true Dolphins, though broader even than is usual in these, and it is perforated a little on one side of the middle by the foramen seen among Whales and Dolphins generally.

Articular faces transverse oval; centrum slightly constricted with an obtuse keel along the median line. The two inferior keels of the caudal vanish on part of the middle of the centrum.

	In.	Lin.
Length centrum	1	9
Height "		10·3
Width "		12 5
" neural canal		5·2
" basis diapophysis lumbar.		10·5
" " " caudal		10·

A dorsal vertebra which relates in age and size with the preceding, is more than usually constricted lateromedially, the inferior line concave, and slightly keeled; length 16½ l., width 12·5 l.

This species is dedicated to W. S. W. Ruschenberger, M. D., of this city, an active member of the Academy, and author of introductory works on Natural History.

Delphinapterus lacertosus Cope.

This is much the largest species of the genus. It is based on two lumbar vertebræ which have been united by an exostosis and then separated. They are quite elongate and have broad diapophyses so far as their bases indicate. The articular surfaces are about as broad as deep, and slightly pentagonal in outline, not ovoid or discoid as in other species. The lower surface presents an obtuse median angle, with slightly concave sides. The general proportions can be derived from the measurements.

	In.	Lin.
Length centrum	3	5·5
Heighth articular surface	2	2·5
Width " "	2	4·5
" neural canal		7·5
" base diapophysis	1	9

In addition to the above, there are in the Museum of the Academy specimens of dorsal lumbar and caudal vertebræ of this species from the Miocene of Cumberland county, New Jersey. They all belong to one individual and represent the characters of the species well. The lumbars are all strongly keeled below, and the dorsals narrowly rounded, and slightly concave on each side. One posterior caudal, with rudimental anterior zygapophyses exhibits rather short diapophyses pierced by the vertical foramen. I therefore refer this species to Tretosphys with the remark, that it is not so typical as the first mentioned species, where the perforation is at the middle of a broad, well developed transverse process.

The two species which follow are assigned to this genus, only on account of their resemblance to the present one, as I have not seen the caudal vertebræ of either. They may be thought to rest on but a slight basis—but as they are extremely easily distinguished among several bushels of bones of other species, I feel entire confidence in their reliability.

Delphinapterus tyrannus Cope.

This is a large species, doubtfully of the genus, not uncommon in the Miocene formations of Maryland. It is represented in the collection by one dorsal and three lumbars. Three of these serve as the type of our diagnosis. They are much shorter in relation to their other dimensions than those of any other fossil dolphin herein described, except the Ixacanthi, and they have the broad diapophyses of the genus Delphinus. The epiphyses are unfortunately lost, and but three of the specimens belong to the same individual. Articular surfaces broader than high, lateral faces concave everywhere and in every direction; below they meet in an obtuse concave ridge.

	In.	Lin.
Length centrum lumbar (epiphyses supplied)	3	
Depth "	2	10·5
Width "	2	3·2
" neural canal		6·7
" basis diapophyses	2	0·5
Length lumbar of larger individual		

The rugosity of the epiphysial surfaces is less marked and more intrerupted, *i. e.* without radiating ridges, than in any other species.

Delphinapterus hawkinsii Cope.

This species is based on two lumbar veterbræ, which resemble those of P. conradi, (*Delphinus conradi* Leidy), but are of much larger size and are furnished with a strong and acute keel below on the median line, as is seen in no other species. The diapophyses are very wide at the base; centrum much depressed. Both these specimens are young and have lost their epiphyses; with the latter, they would be relatively as slender as those of D. lacertosus; they differ from the latter in their deep keel, like that of a boat.

A dorsal vertebra is with much probability referred to the same species. It is therefore a little shorter than the lumbars and has not so strong a keel; yet the latter is more marked than in any other species, contrasting much with the round face of the D. lacertosus. It is adult with fixed epiphyses; the articular faces are subround. The upper part of the diapophyses come from the base of the neural arch, and the neural canal is wide, with median ridge as usual.

	In.	Lin.
Length, dorsal, centrum	2	11·5
Depth articular face	2	0·5
Width of " "	2	2·5
" " centrum at base transverse margin of diapophysis	2	10·3
Length centrum lumbar	3	6
Width in front diapophysis	2	5·2
" of "	1	10·5
Depth centrum from canal to edge of keel	1	10·5

This species is named for my friend B. Waterhouse Hawkins, the restorer of the extinct mammals and reptiles at Sydenham Palace, England, who is now engaged in the Museum of the Academy on a similar work for the Central Park, New York.

Delphinapterus gabbii Cope.

This species is indicated by a well preserved caudal vertebra of an adult, which is so different from anything else in our Museum as to require notice. It has pertained to a species of not more than half the length of the T. grandaevus, and is less strongly constricted everywhere and especially below. In a caudal of near the same position, the ridges and chevron articular surfaces are much more elevated, especially those on the anterior part of the centrum. They embrace a very deep groove in this, a shallow one in the T. gabbii. An additional longitudinal ridge on each side the inferiors in front is wanting in T. gabbii. Both have a delicate one above the diapophyses in front, the T. grandaevus behind also. There is no posterior zygapophysis in the T. gabbii; the caudal of the latter is also relatively shorter.

	In.	Lin.
Length centrum	2	
Depth articular face anterior	1	5·7
Width " " "	1	7

This species is dedicated to my friend Wm. M. Gabb, Palæontologist of the State Geological Survey of California.

To this genus belongs also the Priscodelphinus grandaevus of Leidy. This species is not rare in our collections.

I may add that there still remain species of Delphinidæ in the collection which are as yet undescribed.

BALÆNIDÆ.

The vertebræ of several rather small species of this family were procured by J. T. Thomas, of which a few are sufficiently characteristic for description. They are accompanied by the other bones of the body, but as these must be allocated with much care and labor, and as the vertebræ are most abundant and therefore characteristic of the beds, I think best to describe them from these.

ESCHRICHTIUS Gray.

Eschrichtius pusillus Cope.

This species is indicated by many vertebræ, of which one dorsal, six of the lumbars, and one caudal may serve as types. They indicate a species of less size than any heretofore described, except perhaps the B. rostrata now living. They are about half the size of the vertebræ of Balænoptera prisca and B. palæatlantica, and 3-5ths those of Eschrichtius cephalus.

The dorsal is a little longer than transverse width of centrum, and 2-5ths longer than vertical width of the same; the latter is therefore a depressed oval. Inferior surface a regular arch from side to side. The lumbars have the usual median keel, and the articular faces are not quite so transverse; the external planes are generally concave. The venous foramina in these are so small as not to be noticeable.

The articular faces of the caudal are a little more compressed and nearly as deep as wide. The two inferior keels are very slight, the diapophysis are not perforate, and the neural arch stands on 3-5ths length of the centrum.

	In.	Lin.
Length dorsal	4	11
Height articular face	3	6·2
Width " "	4	3
Width neural canal	1	4
Lumbar length	4	11
Height articular surface	3	11
Width " "	4	2
" neural canal		10
Caudal, length	4	
Height articular surface	3	9 5
" to zygapophyses	5	2
Width articular surfaces	4	

Several cervical vertebræ show the characters of the genus and species. They are all distinct, and their parapophyses and diapophyses have not probably been united, as the portions of them remaining are quite slender.

The superficial dense bony layer of the ramus of the mandible, of which we have specimens, is well developed, and nowhere fissured, and the nutritious foramina small. The ramus moderately convex on both faces, much as in the Balænoptera prisca, (*Balæna* Leidy), and like it, the nutritious foramina were arranged in a series on each side of and close to the median superior ridge. What distinguishes it from the latter is the presence of a distinct median ridge, which separated from the inner face of the ramus by a strong longitudinal groove. The nutritious foramina of the inner side penetrate along the line of this groove. The size is about one-third the same portion of the jaw of the B. prisca. Like the latter its inferior margin is greatly decurved, and the outer side more convex than the inner.

	In.	Lin.
Length of fragment	15	
Depth inner face	2	
Circumference	5	2·5

Remains of the mandibles of this species are not uncommon in the Miocene region in the beds of streams. I have in similar situations dug out the vomers of two whales whose size would correspond with the present. Bullæ of the periotic bones of small Balænidæ are not uncommon in the same beds, and I suspect are mostly to be referred to this and the succeeding species.

The species appears to occur in the phosphatic deposit of the neighborhood of Charleston, South Carolina, as I have a specimen of a lumbosacral vertebræ from that locality. It was among the toothless whales what the small elephant of Malta was to the giant elephants. Our specimens have belonged to individuals of not more than fifteen feet in length, and probably adult.

MEGAPTERA Gray.

MEGAPTERA EXPANSA Cope.

This species is based on numerous vertebræ from the Thomas collection, several from the Nomini Cliffs, Westmoreland county, Virginia, presented to the Academy by my friend Oliver N. Bryan, of Charles county, Md., and by some in the Academy's Museum from Virginia.

The cervicals have a greater antero-posterior diameter than those of the Eschrichtius species, but show quite similar di- and parapophyses. They are, however, not at present in my possession, and their full description must be postponed for a time.

There are also ten dorsals and several lumbars and probably some cervicals from the same collection. The former have a broad and capacious neural canal, and the diapophysis is given off in all from the neural arch. In the lumbars this process is of course given off lower down, but in them it is flatter than usual. The centrum has somewhat the form of some of those of Doryodon, being broad and of little antero-posterior diameter. The articular faces have a transverse subcordate outline, being flat above. The basal face without keel. The form of the epiphyses indeed approaches subtrigonal.

	In.	Lin.
Length anterior dorsal	2	9
Height articular face	2	8
Width " "	4	
" neural canal	1	9·7
Length median dorsal	3	2·5
Height articular face	3	0·5
Width " "	3	7
" neural canal		14·5

The size of this species is quite comparable to that of the Eschrichtius pusillus, being one of the smaller species. The elevated position of its diapophyses distinguishes it from all the Squalodons.

The extinct species of Balænidæ of the United States are the following:

MEGAPTERA EXPANSA Cope.
ESCHRICHTIUS CEPHALUS Cope.
ESCHRICHTIUS LEPTOCENTRUS Cope.
ESCHRICHTIUS PUSILLUS Cope.
BALÆNOPTERA PRISCA Leidy.
BALÆNOPTERA PALÆATLANTICA Leidy.

There is no evidence that either of the two last named species are true Balænopteri. They may be Eschrichtii, but cannot at present be referred to those known as above.

It is to be observed that none of the Miocene species exhibit the dimensions possessed by the largest existing species, while several of them are smaller than the least of those of modern seas. The present period would appear, with present information, to be that in which these monsters have attained their greatest bulk.

The recent Balænidæ of our coasts are the following:

BALÆNA MYSTICETUS Linn., Polar Sea.
BALÆNA CISARCTICA Cope, Temperate Sea.
BALÆNA CULLAMACH Cham., North Pacific.
AGAPHELUS GLAUCUS Cope, Temper. Pacific.
AGAPHELUS GIBBOSUS Erxl., Temp. Atlantic.
MEGAPTERA OSPHYIA Cope, " "
MEGAPTERA LONGIMANA Gray, Polar Seas.
ESCHRICHTIUS ? ROBUSTUS Lillj., Temp. Atlantic.
BALÆNOPTERA ROSTRATA Fab., North Atlantic.
SIBBALDIUS LATICEPS Gray, North Atlantic.

The following notes on these species may be in place here.

Of the Balæna cisarctica there is a skeleton in the Museum of the Academy of an individual of thirty-seven feet, and a ramus mandibuli of sixteen feet in length, indicating a total of sixty-eight feet adult size. A scapula in the Museum Rutger's College, New Brunswick, N. J , measures 36 inches in height, and 48 5 in. in width, indicating an adult of 57 feet in length. A young individual of 45 feet line measurement, awaits mounting in the Museum Compar. Zoology, Cambridge, Mass. Of this individual I will shortly give a detailed description in an essay on the species Like the other specimens, it presents a strong acromion. The phalanges of the manus exhibited an important difference from those of B. australis. In it they number respectively 2—5—6—3—3, while Cuvier gives (Oss. Foss. 227, 23) 2—5—6—5—4.

The species of Agaphelus are briefly noticed in the present number of the Academy's proceedings. They will be more fully described shortly from material at present in hand.

A second and more full examination of the skeleton of the Megaptera osphyia Cope, furnishes the following additional points and characters. The specimen is young, and measures in its present condition, 34 feet. It has, however, lost a considerable number of caudal vertebræ, and from the posterior part of the column, of intervertebral cartilages also; add to this the shrinking of the cartilages preserved, and the increase of length would perhaps amount to eight feet, giving 42 in all. The asserted length of fifty feet line measurement, which I quoted in my original description, is no doubt an exaggeration.

The glenoid process is margined by an angular prominence, the rudiment of the coracoid, precisely as in the M. brasiliensis. The diapophysis of the atlas is a flat vertical plate, extending from opposite the base of the *foramen dentati* to opposite the widest point of the spinal canal; inferior posterior outline of the atlas broad, slightly concave medially. The mandible is peculiar in the strong angular process, which extends from behind round the side, projecting as far as the condyle, and separated from it by a deep groove. The third and fourth cervicals are united by the neural arch. The first rib is very broad at the extremity; length 37 inches, width at end, 8·22 in. The orbital processes of the frontal bone are not contracted at the extremities as in M. longimana, but are more as in Balænopteræ; entire width over and within edge of orbit, 15½ in.; length to vertical plate of maxillary 31 in. The baleen measures two feet in length, is black, with three rows of coarse bristles. Its base is one curve; its length is spirally twisted.

The species is probably one of the largest of the Balænidæ.

The Eschrichtius robustus is admitted on the evidence of a ramus of the under jaw in the Museum Rutger's College, which is of peculiar form, and closely resembles the figure given by Lilljeborg of that portion of this rare species.

August 4*th.*

The President, Dr. Hays, in the Chair.

Eighteen members present.

August 11*th.*

Mr. Cassin, Vice-President, in the Chair.

Twenty members present.

On favorable report of the committees, the following papers were ordered to be published:

Notice of some remains of HORSES

BY JOSEPH LEIDY, M. D.

Mr. W. Lorenz loaned me for examination a horse tooth, black in color, and devoid of its outer cementum, from diluvium, occupying a depression about six feet in depth and about twenty feet in breadth, in the Silurian slate, between Rutherford's Station and Highspire, Lebanon Co., Pa. It is stained in texture with iron, mutilated at its lower part, and not petrified. It is a fifth upper molar of an individual which had just attained maturity, and does not differ characteristically from the corresponding tooth of the recent horse at the same age. The inflection of enamel at the bottom of the principal internal valley of the triturating surface is minute, but this is the case occasionally in the corresponding tooth in the living horse. The size of the tooth also is about that of the ordinary full-sized horse. The measurements, in comparison with a fifth molar contained in a recent horse skull, are as follows:

	Fossil.	Recent.
Length	40 lines.	34 lines.
Breadth fore and aft	$15\frac{1}{2}$ "	15 "
Width, transversely	12 "	12 "

The tooth may be viewed as having belonged to an indigenous horse, a cotemporary of the Mastodon, but it is equally improbable.

Prof. Whitney has recently submitted to my inspection a fossil horse tooth from Martinez, Contra Costa Co., California, the largest I have ever seen or can recollect of being on record. The formation from which it was derived Prof. Whitney considers to be of pliocene age. The tooth is well preserved, retaining its outer cementum, and is but slightly, if at all, changed in texture. The tooth is a second upper molar, nearly half-worn. The triturating surface in its arrangement of the enamel presents nothing strikingly different from that of the corresponding tooth of the recent horse. As in this there is an inflection of the enamel at the bottom of the principal internal valley, and in this respect and the less simplicity of folding of the enamel islets of the triturating surface, differs from *Equus excelsus* of the Niobrara and of California. The tooth probably represents an extinct species, upwards of eighteen hands high. Its measurements are as follows:

Length along the outer median column to the origin of the fangs	$26\frac{1}{2}$ lines.
Breadth of triturating surface fore and aft	$16\frac{1}{2}$ "
Thickness independent of cementum	15 "
" with cementum	16 "

The species represented by the tooth may be distinguished by the name of EQUUS PACIFICUS. I had previously seen fragments of an upper molar and two lower molars, apparently of the same species, from the same locality, submitted to my inspection by Prof. Whitney several years ago.

Coincidentally, Dr. Le Conte has just handed to me a bone indicating the smallest species of horse of which I have any knowledge. The bone, a second ungual phalanx or coronary bone, together with the proximal end of a metacarpal of a ruminant, were obtained by John C. Browne from a well 60 feet deep, at Antelope, Nebraska, 450 miles west of Omaha. The coronary bone in its axis is 9 lines long; the same width at the proximal end, and rather more than a line less at the distal end. From its relation of size with that of the recent horse, the animal to which it belonged was about eight hands high. It is uncertain to what solipedal genus the bone actually belongs, but in the absence of more characteristic materials, it may be viewed as representing a species of *Equus*.

Notice of some extinct CETACEANS.

BY JOSEPH LEIDY, M. D.

HOPLOCETUS OBESUS.

Prof. F. S. Holmes, of Charleston, S. C., has recently submitted to my inspection a remarkable tooth and the fragment of another, which I recognize as having belonged to an extinct genus of Cetaceans, characterized under the name of *Hoplocetus* by Gervais, from similar teeth derived from the miocene and pliocene formations of France. The tooth, indeed, bears a near resemblance to that of *H. crassidens*, represented in figure 10, plate xx, of Gervais' Paléontologie Francaise, both in form and size, but is more curved, in this respect resembling more the tooth of that represented in fig. 11 of the same plate. Prof. Holmes' specimens were obtained from the post pliocene formation of Ashley River, in the vicinity of Charleston, S. C.

The more complete tooth has the end of the fang and a good portion of the crown broken away. The latter was worn away, leaving on the summit a broad, flat, discoidal surface. The enamel, where it remains, forms a band encircling about one-third of the crown, about three lines in depth, and one-fourth of a line thick. It appears to have been rugose longitudinally. The fang, a striking character in the teeth referred to *Hoplocetus*, is fusiform, remarkably robust, and large in proportion to the crown. It is straight at the bottom two-thirds, but curved towards the crown, so that this appears to be obliquely implanted upon it. The interior of the fang is pervaded by a narrow pulp cavity of irregular diameter, from the existence at its sides of nodosities. The part constituting the technical neck of the tooth is feebly constricted. The measurements of the specimen are as follows:

Length in present condition in a straight line	44 lines.
Estimated length of fang restored	52 "
Greater diameter of fang	19 "
Lesser " "	$16\frac{1}{2}$ "
Estimated diameter of crown at base	8 "

The fang of this tooth appears to consist of an axis of dentine about equal in diameter to the crown, and its great accession of bulk appears to be due to the cemental layer.

The second specimen consists of the fragment of a tooth devoid of crown. The tooth has been of little greater bulk than the preceding, as the diameter of the remaining portion of the fang is $20\frac{1}{2}$ lines.

Almost immediately after the reception of the above specimens, quite unexpectedly and purely coincidentally, I received, among some other cetaceous remains, another tooth, referable to *Hoplocetus*, from my friend, Prof. Wyman of Cambridge. This specimen was derived from the miocene formation in the vicinity of Richmond, Va. The tooth is much larger and straighter throughout than the better preserved of the two preceding specimens, and may perhaps belong to a different species,—a conjecture which is favored in the fact that the tooth was also derived from a different geological formation.

The crown is worn off in a blunt manner or somewhat convex disk, about 9 lines in diameter, and is encircled by a more or less worn and broken band of longitudinally rugose enamel, varying in depth from three to five lines, and one-third of a line in thickness. The fang is broken at its end, and exhibits a long conical pulp cavity, large enough to introduce the end of the middle finger for an inch or more. The fang in shape is fusiform, exceedingly robust, straight, and somewhat quadrate. As in the other specimens, it is composed of a dentinal axis near the diameter of the crown, enveloped in a huge accumulation of cementum. The length of the specimen in a straight line, in its present condition, is 55 lines. The fang in a restored condition is estimated to have been 5 inches long. The diameter of the fang is 20 and $21\frac{1}{2}$ lines.

In the large proportion of cementum to the dentinal axis of the teeth of *Hoplocetus* they bear such a resemblance to the fragments found in the Red Crag of England, and referred by Prof. Owen to a genus under the name of *Balænodon*, as to render it probable the former is the same as the latter.

The relations of *Hoplocetus* or *Balænodon*, other than that they were toothed cetaceans, are unknown.

Delphinus occiduus.

An extinct species is indicated by a fossil derived from the upper miocene formation of Half-moon Bay, California, submitted to my examination by Prof. J. D. Whitney. The specimen consists of an intermediate portion of the upper jaw, devoid of teeth, and encrusted with selenite. It measures along the more perfect lateral border 5 inches, and in this extent is occupied with 19 closely set, circular alveoli, rather over 2 lines in diameter. At the back of the fragment the jaw has measured a little more than 2 inches wide. From this position it gradually tapers for half its length, and then proceeds with parallel sides to the fore end, where it is $10\frac{1}{2}$ lines wide. The palate behind is nearly plane or slightly convex; at its fore part it presents a deep median groove, closed by the apposition of the maxillaries, and this groove is separated only by a narrow ridge from the alveoli. The sides of the maxillaries are slightly concave longitudinally, convex transversely. The intermaxillaries are broken away, leaving a wide, angular gutter between the remains of the maxillaries.

Remarks on a jaw fragment of MEGALOSAURUS.

BY JOSEPH LEIDY, M. D.

A fossil worthy of notice in the Museum of the Academy consists of the fragment of a jaw, apparently of the Megalosaurus, which, if it does not belong to a different species from *M. Bucklandi*, indicates an individual larger than any one of those referred to by Buckland, Cuvier, Owen, etc. The fossil was purchased in England, and was presented to the Academy by Dr. Thomas B. Wilson. It is labelled, "Fragment d'une machoire de Megalosaurus trouvé dans le lias à Boué (or Boues). L'animal est extremement rare ici. Il avait 45 pied de longeur." In another hand it is marked "Jura Mts."

The fragment contains two mutilated teeth, visible throughout their length from the inner part of the jaw being broken away. The matrix adhering to the fossil consists of an oolite composed of a homogeneous clay-colored basis, with imbedded granules, of a rounded form, brown and shining.

The teeth are inserted into the jaw about two-thirds their length, and more than three-fourths the depth of the bone. They have measured $5\frac{1}{2}$ and 6 inches in length. The breadth at the base of the enamelled crown of the best preserved tooth is $14\frac{3}{4}$ lines, which is nearly the fourth of an inch greater than in the largest tooth represented in any of Prof. Owen's figures in his Monograph of the Fossil Reptiles of the Wealden Formation. A tooth apparently nearly as large in an American ally, is one referred to *Dinodon horridus*, and represented in fig. 21, pl. 9, of my memoir on the Extinct Vertebrata of the Judith River, published in the eleventh volume of the Transactions of the American Philosophical Society. The reconstructed outline of this figure is, however, too large, rendered so by the too distant removal of the apex of the tooth from the other fragment. The breadth of this specimen really did not exceed an inch.

The longest tooth of the fossil under inspection, for the most part broken away, exhibits a mould of the large interior pulp cavity. This mould, from the bottom of the latter to its broken end in the position of the crown, is $5\frac{1}{4}$

inches long. The broken end is 8 lines wide and $1\frac{3}{4}$ lines thick; the widest and thickest part of the mould near the middle of the length of the tooth is $11\frac{1}{2}$ lines wide and 5 lines thick.

The fangs of the teeth do not continue of the same width to the bottom, as in the teeth of crocodiles, and, as I believe, is considered to be the case in *Megalosaurus*, but from about their middle they contract, or become narrower, as is ordinarily the case in mammals. Indeed, one of these teeth isolated might be taken for the canine of a *Drepanodon*, or sabre-toothed tiger. In the fossil the bottoms of the fangs narrow antero-posteriorly, and become thinner from without inwardly, and they also curve somewhat in the latter direction.

The long fangs of the teeth in the fossil, and their becoming narrowed at bottom, at first led me to suspect the specimen belonged to a different genus from *Megalosaurus*, but a view of fig. 1, plate xii, of Prof. Owen's monograph above mentioned, seems to prove by the appearance of the successional teeth within the jaw, that the fangs actually become narrowed towards the bottom in that genus.

In the best preserved tooth of the fossil, the enamelled crown exhibits the same shape, familiar as the characteristic form of that of *Megalosaurus*. The trenchant borders of the crown are denticulate, and the enamel is comparatively smooth, or only very feebly striate.

The contracted condition of the bottom of the fangs of the teeth would leave more space than there otherwise would be for the development of successional teeth within the jaw. In the fossil the remains of one of the latter is seen at the lower part internally of one of the functional teeth, and an impression in a corresponding position of the other functional tooth indicates a similar occupant.

In the progress of the successional teeth of *Megalosaurus*, their summit first appeared at the margin of the jaw internally to the teeth in functional position. In the course of growth and protrusion they excited absorption in the contiguous bone and fang of their predecessors, and continuing to advance from within and beneath (in the lower jaw), as it were, shouldered the latter from the jaw. A third tooth in *Megalosaurus* appears to have occupied a position internal to the second one, before the protrusion of this from the jaw.

The outer portion of the jaw bone retained in the specimen has an average depth from the alveolar border of 5 inches. Its outer surface is a vertical plane, rounding only near the base.

The present opportunity is an appropriate one to make a few remarks on the American allies of *Megalosaurus*. Since I have had the opportunity of inspecting the remains of the remarkable reptile from the green sand of New Jersey, described by Prof. Cope (Proc. 1866, 275) under the name of *Lælaps aquilunguis*, in observing the comparative uniformity of the teeth, identical in character with those of *Megalosaurus*, I am more strongly impressed with the idea that the teeth of like shape forming part of those referred by me to *Dinodon*, alone belong to this genus. The others, of which no representatives have been discovered or recognized as belonging to *Megalosaurus* or *Lælaps*, most probably indicate a distinct genus and species, for which I propose the name of AUBLYSODON MIRANDUS.

Future discovery may prove *Lælaps* and *Dinodon* identical, and, judging from the comparison of corresponding parts of the jaws and the teeth, will be found to be more closely allied to *Megalosaurus* than was suspected, even should they not prove to be generically the same.

It is clear, from an examination of the anterior portion of the mandible of *Megalosaurus* described and figured by Buckland, Cuvier, Owen, etc., that no such teeth as those now referred to *Aublysodon* occupied the forepart of the jaw. It is also probable that the upper teeth of *Megalosaurus* and of its allies differ in no important point from those below. It follows, therefore, that the teeth now referred to *Aublysodon*, if they belong to the maxillary or mandibular series of *Megalosaurus* or its allies, could only pertain to the back part. The variation in form of the teeth in question appears too great for such a position.

The teeth now viewed as characteristic of *Aublysodon* are represented in figs. 36—45, pl. ix of vol. xi of the Transactions of the American Philosophical Society. The specimens consist of parts of three teeth, which differ much in size and other important points. In general the crowns are laterally compressed conical, with the anterior part thick and convex transversely as well as longitudinally, and with the sides nearly parallel. The posterior part forms a surface nearly as wide as the thickness of any part of the crown, and is defined from the lateral surfaces at right angles. In the two larger teeth these angles or borders are denticulated, like the trenchant borders of the teeth of *Megalosaurus* and its American allies. In the longest tooth (fig. 35, 36, op cit.) the posterior surface forms an even plane; in the second sized tooth (figs. 37—40) the posterior surface presents a median elevation. In the smallest tooth (figs. 41—45), which indeed may belong to a different animal from the preceding, the borders defining the posterior surface are somewhat prominent backward, non-denticulate, and subside approaching the base of the crown so as to make a transverse section in this position oval (fig. 45).

Hadrosaurus Foulkii, the bulky vegetable feeder, and cotemporary of the rapacious *Lælaps aquilunguis*, was at most probably only specifically distinct from *Trachodon mirabilis*, the teeth of which were found in association with those of *Dinodon*, so that, according to the laws of nomenclature, as *Trachodon* has priority of name, I suppose the first mentioned animal must be called *Trachodon Foulkii*, though the names of *Hadrosaurus Foulkii* and *H. mirabilis* would appear more appropriate for these powerful dinosaurs.

The best preserved tooth of those originally referred to *Trachodon*, represented in figs. 1—6 of the plate above cited, is identical in form with those referred to *Hadrosaurus*, and differs only in the absence of the rugulations of the lateral borders of the crown, and in some less important points.

The remaining specimens of teeth referred with the former to *Trachodon*, are represented in figs. 7—20 of the plate cited. Most of them are so worn and probably altered from their original form, that it is rendered uncertain whether they belong to the same animal as the preceding tooth, and one unworn (figs. 18—20) has a very different shape from this. Perhaps these specimens belonged to another Dinosaur, for which the name *Trachodon* might be reserved, while that of *Hadrosaurus* might include the first mentioned and more characteristic tooth.

As *Iguanodon* had its enemy in a species of *Megalosaurus*, *Trachodon*, the representative of the former both in the western and eastern portions of the North American continent, was accompanied by an equally bloodthirsty enemy, which may, perhaps, on nearer comparison of corresponding parts, prove to be another species of the same genus, until now supposed to be different, under the names of *Dinodon* and *Lælaps*.

Prof. Cope remarks of *Lælaps* (Pr. A. N. S. 1866, 276), that "in its dentition and huge prehensile claws it resembled closely *Megalosaurus*, but the femur, resembling in its proximal regions more nearly the *Iguanodon*, indicated the probable existence of other equally important differences, and its pertinence to another genus." Thus the genus is especially distinguished by the apparent peculiarity of the femur, but in my estimation even this disappears if the bone referred to *Lælaps* be viewed in the corresponding position to that of *M. Bucklandi*, represented in pl. vii, pt. iii, of Prof. Owen's Monograph of the Fossil Reptiles of the Wealden, which appears to me to be the reversed one to that in which Prof Cope has described it in Pr. A. N. S. 1866, 276.

The teeth of *Bathygnathus*, a huge carnivorous reptile, whose remains have been found in the triassic red sandstone of Prince Edward's Island, have the same form as those of *Megalosaurus*, *Dinodon* and *Lælaps*. But here, so far as we have the corresponding parts for comparison, the resemblance ceases. The remarkable depth of the dentary bone in relation with its length in *Bathygnathus*, indicates a form of head very different from that of *Megalosaurus* and its American representatives. It was this unusual relation of depth to breadth which led me to suspect a form of head more in accordance with that of the skeleton of an upright animal, and led me to ask the question, "was this animal probably not one of the bipeds which made the so-called bird tracks of the New Red Sandstone of the valley of the Connecticut?" (See Jour. Ac. Nat. Sc. 1854, 329.)

Subsequently, in examining the remains of *Hadrosaurus*, the American representative of *Iguanodon*, from the great disproportion between the fore and hind parts of the body, I was led "to suspect that this great herbivorous lizard sustained itself in a semi-erect position on the huge hinder extremities and tail, while it browsed on plants growing upon the shores of the ocean." (Cret. Rept. of the U. S. 1865, 97.)

The remains referred to *Lælaps* exhibit even a far greater disproportion between the fore and hind limbs than in *Hadrosaurus*, which, together with its long bird-like claws, etc., suggested to Prof. Cope a similar position of body to that of *Hadrosaurus*, and a use of the hind limbs in attack upon the prey of the animal analagous with that in the eagle (Pr. A. N. S. 1866, 279). The extraordinary disproportion between the fore and hind limbs of *Lælaps*, which appears to me so closely related with *Megalosaurus*, leads me to suspect that the remains described by Buckland, Cuvier, Owen and others, and attributed to the shoulder of *M. Bucklandi*, perhaps, at least in part, belong to the pelvis, if they in whole or part do not belong to other animals. Had the humerus of *Lælaps* been found isolated, I never would have thought of associating it in the same skeleton with the huge bones of the hinder extremity of that animal. Perhaps, when this great disproportion comes to be known, it may be discovered that there exist specimens of remains of the fore limbs of *Megalosaurus*, from the Wealden, in the British or other museums of England, which heretofore have excited no suspicion as to their true relations.

Teratosaurus, from the upper Keuper, in the vicinity of Stuttgart, described by Meyer (Palæontographica, 1859–61, 258), approached *Bathygnathus* most in the proportions of its face, as well as resembled it in the form of the teeth, but the fossil dentary bone of the latter is even still shorter and deeper than would relate to the fossil maxillary of the former.

Remarks on CONOSAURUS of Gibbes.

BY JOSEPH LEIDY, M. D.

In a memoir on *Mosasaurus* and the allied genera, by Dr. R. W. Gibbes, published in the second volume of the Smithsonian Contributions to Knowledge, the author described some teeth from the eocene formation of Ashley River, South Carolina, which, from their general resemblance with those of *Mosasaurus*, both in form and conjunction with osseous bases, he referred to a reptile with the name of *Conosaurus Bowmani*.

An examination of the structure of these teeth proved to me that they belonged to a fish. The body of the crown is composed of a compact vaso-dentine, invested, in place of enamel, with a thin layer of ordinary dentine. There is no pulp cavity in the interior; and in the complete teeth, the crown is continuous with a robust osseous fang, resembling in general appearance that of the teeth of *Mosasaurus*.

A short time since Prof. F. S. Holmes submitted to my examination the dentary bone of *Conosaurus*, imbedded in a block of white eocene marl, from the vicinity of Charleston, South Carolina. The specimen fully confirms the view that the animal is a fish.

The dentary bone, from its symphysis to where it articulated with the angular bone, judging partly from the bone itself and the impression of the remainder on the matrix, has been a little over six inches in length. Its depth at the symphysis has been about two and a quarter inches.

Twelve teeth have occupied the alveolar border in a space of four inches and ten lines, and perhaps a couple more occupied the part broken away behind. The teeth form an unbroken row, close together, and generally differ but little in size, though those posteriorly are a little the smaller.

The perfect crown of the teeth forms a nearly regular cone, the fore and aft diameter of the base slightly exceeding the transverse. It is curved inwardly, pointed, smooth, shining, and even, except at the base, where it is slightly fluted, being most so in the anterior teeth, and more or less feebly so in the hinder ones.

The crown ceases at the alveolar margin, where it becomes continuous with a more robust, solid, oval fang, which is inserted into the jaw and coössified with its alveolus.

In the dentary bone above mentioned, the crown of the first tooth, or that nearest the symphysis, is broken off, displaying a clean continuous disk of vasodentine, nearly circular, and about four lines in diameter. The fang is visible from a destruction of a portion of the bone. It is half an inch long, of greater diameter than the base of the crown, and composed of bone hardly more dense than that of the jaw itself, with which it is coössified. The fourth tooth of the series is in the same condition as the former.

The crown of the second tooth had been shed, and its remaining solid fang is somewhat encroached upon, through absorption, by the fang of the tooth in front.

The third, eighth and twelfth teeth have been shed, and their fangs absorbed, leaving deep oval cavities. These were filled with matrix, and nothing more. It is probable they contained successional teeth, which dropped out in the decomposition of the animal.

The fifth tooth had been shed, and its remaining fang contains a funnel-shaped pit.

The sixth and tenth teeth alone remain in the specimen, the latter entire, the former without its point. The crown of the sixth was nearly eight lines long; the other is seven lines.

The crown of the seventh tooth has been broken off, and the fractured surface displays a small central cavity.

The crown of the ninth tooth, which was smaller than any of the others, is shed, leaving the fang somewhat excavated; but the sides are narrowed, as if the position of the tooth were to have been obliterated to give more room for the accommodation of others.

Back of the tenth tooth there is a small pit, probably the remains of the position of an early tooth smaller than that last indicated. This included would give thirteen to the series.

The crown of the eleventh tooth had been shed, leaving a shallow basin on the top of the fang.

I could find no successional teeth in the specimen. Those which existed appear to have dropped out of the exposed cavities.

From a study of the fragment it would appear as if the germs of new teeth originated in the centre of the preëxisting teeth,—that is, at the conjunction of the crown and fang. In the development of the new tooth it was first accommodated in its growth by the absorption of the fang of the old tooth. The crown of the latter being shed, that of the new one gradually assumed its position, and when protruded its fang became coössified with its alveolus.

A specimen in the museum of the Academy, from Ashley River, S. C., consisting of an isolated tooth with the greater portion of its fang, is larger than any of the teeth in the dentary bone above described. The crown is eight lines long and four and a quarter in diameter at base. The fore and back part of the robust osseous fang present concavities, as portions of cavities remaining after the shedding of teeth with absorption of their fangs.

Of two shed crowns in the museum, from the same locality, one is $5\frac{1}{2}$ lines long by $2\frac{1}{4}$ and $1\frac{3}{4}$ in diameter at base; the other $6\frac{3}{4}$ lines long by $3\frac{3}{4}$ and $3\frac{1}{2}$ at base.

The museum of the Academy also contains two specimens consisting of alveolar fragments of jaws with teeth, of the same animal, from Burlington Co., N. J. They were presented by W. J. Taylor, and are reputed to have been obtained from the green sand.

One of the specimens is $2\frac{1}{2}$ inches long, and contains an alternation of teeth and empty cavities for successional teeth. The first cavity is large, the fang formerly occupying its position being completely absorbed. The second tooth of the specimen is entire. Its crown is 7 lines long by 4 and $3\frac{1}{2}$ at base. The third and fifth cavities for successional teeth are not quite so large as the first, nor are the fangs which occupied them so completely absorbed. The fourth tooth has its crown mutilated. Its base behind is irregularly excavated, but whether by erosion, or whether it is the remains of a position occupied by a successional tooth, I cannot determine. In the sixth tooth the crown is not entirely protruded, and its fang is already coössified with a tubular sheath of the fang of the former tooth which occupied its position. In the seventh tooth the crown is shed, but the fang remains with a large cavity. The crown of the eighth tooth was also shed and the fang nearly obliterated through absorption.

The smaller alveolar fragment is $1\frac{1}{2}$ inches long, and contains two teeth, with an intervening cavity for a successional tooth. Before and behind the two teeth are the remains of other cavities.

Though I have an aversion to change names, yet the name *Conosaurus* is so obviously wrong and liable to mislead, especially also as there is a saurian named *Coniosaurus*, that I propose for the former the name of CONOSAUROPS.

I may here take occasion to mention that I have suspected that the tooth represented in figs. 7, 8, 9, pl. xx, of my "Cretaceous Reptiles of the United States," and referred to a carnivorous reptile with the name of *Tomodon*, may also have been a fish. The base of the specimen presents an irregular porous condition, but this I suspect rather to be the result of erosion. As it is unique, I have not been able to obtain a section to examine its microscopic structure. As the name *Tomodon* had been previously appropriated by Duméril for a genus of serpents, I would propose to alter the name applied to the animal to which the fossil belonged, to that of DIPLOTOMODON.

August 18th.

The President, DR. HAYS, in the Chair.

Sixteen members present.

August 25th.

The President, DR. HAYS, in the Chair.

Twenty-three members present.

Messrs. Uselma Smith and B. Waterhouse Hawkins were elected members.

Mr. Ralph Tate, of London, was elected a correspondent.

On favorable report of the Committee, the following paper was ordered to be printed:

On the Crocodilian genus PEROSUCHUS.

BY EDWARD D. COPE.

Characters.—Toes 5–4, with claws two—three. No osseous nasal septum or bony eyelid. Belly protected by series of osseous plates, as well as the back.

All the genera of Crocodiles hitherto known as living are characterized by the possession of three claws on the fore foot. The present therefore offers a remarkable exception. The free fingers and half webbed toes, and the bony abdominal buckler, together with the cartilaginous nasal septum are points of strong resemblance to Jacare (Gray, including *Cæman* Gray), but it differs from these creatures in the lack of bony orbital plate. In specific characters it differs from those of this genus, which it most resembles, as J. n i g r a, in the absence of a transverse bony ridge between the orbits. Another feature of importance is the relation of the canine teeth of the lower jaw to the upper. On one side this tooth is received into a notch, as in Crocodiles, on the others it enters a pit of the maxillary bone, within the border of the same, as in Alligators! This remarkable combination may be abnormal even in this species, but this cannot be now ascertained, as it rests at the present time on a single specimen only. As its affinities are rather more alligatorial, I am disposed to anticipate that the dental arrangement of the latter type will be most common.

Perosuchus fuscus Cope.

Char. specificus.—Nuchal plates in a cross row of six; cervicals in four cross-rows, all of four plates except the last of two. Dorsal plates six—in a few eight in each transverse row. No posterior crest on arm or leg. Tail short with remarkably low crest. Muzzle broad, flat, without any ridges; its width at the eighth tooth entering 1·4 in length from end of muzzle to anterior margin of orbit.

Description.—The specimen in the Museum of the Academy is young, measuring only 2 feet 5 inches in length. Of this the skull measures to the margin of the supra-occipital 2 in. 10 5 lin.; and the tail from the vent 13 in. 1 line. From groin to heel 3 in. 2·5 lines, and the hind foot 2 in. 7·5 lines. The muzzle is a broad ovate, the sides rather more convergent anteriorly than in the Alligator m i s s i s s i p p i e n s i s. There is a thickening in front of each orbit, and between them on the middle line another, which together enclose two shallow concavities. Superciliary margins raised, the cranial table quite flat. The margin of the quadrato-jugal bone projects strongly. The scales of the limbs are all smooth and those of the dorsal region with very low keels. The sides have four longitudinal rows of ovate scales separated by scarcely defined smaller ones. The abdominal plates are longer than broad, and are in twelve longitudinal rows. Dorsals in seventeen transverse series from interscapular to crural region. The lateral crests of the tail are only obtuse keels; they unite on the thirteenth annulus behind the vent inclusive. Color above dark brown, almost black on the upper surface of the head. The tail is paler, of a light olive brown. Lower surface everywhere bright yellow, including the entire lower jaw and margin of the upper. Eyelids and a band through ear yellow, the former with a black spot above.

Remarks.—This interesting addition to our knowledge of the Reptilia was made by Schulte Buckow, of New York, while on a visit to the interior part of the course of the Magdelena River, in New Grenada. This naturalist has also enriched our collections with other interesting vertebrata of that region, both living and dead.

Sept. 1st.

The President, DR. HAYS, in the Chair.

Twenty-two members present.

Sept. 8th.

The President, DR. HAYS, in the Chair.

Twenty-eight members present.

Sept. 15th.

The President, DR. HAYS, in the Chair.

Twenty-eight members present.

The following papers were presented for publication:

Extinct Mammalia of Dakota and Nebraska, including an account of some allied forms from other localities, together with a synopsis of the Mammalian Remains of North America. Illustrated by twenty-eight plates. By Joseph Leidy, M. D. Preceded by an introduction on the Geology of the Tertiary Formations of Dakota and Nebraska, accompanied by a Map. By F. V. Hayden, M. D.

Notice of American Species of Ptychodus. By Joseph Leidy, M. D.

Synopsis of the Extinct Batrachia of North America. By Edw. D. Cope.

Dr. Leidy read a letter from Mr. B. Waterhouse Hawkins, proposing to erect in the Museum, at his own expense, the fossil remains of the Hadrosaurus to their natural relations in the figure of that great Dinosaur, in accordance with Dr. Leidy's descriptions in his Monograph of the Cretaceous Reptiles of the United States.

On leave being granted, the following resolutions, offered by Dr. J. L. LeConte, were adopted:

That the Academy accept the proposition of Mr. B. Waterhouse Hawkins, to erect in this Hall, at his own expense, a restoration of the skeleton Hadrosaurus.

That the thanks of the Academy be respectfully tendered to Mr. Hawkins for his liberal offer, and that the Curators be instructed to furnish to him every facility in the use of specimens in the Museum, which the most liberal interpretation of the By-Laws will permit.

Sept. 22d.

DR. BRIDGES, in the Chair.

Twenty-four members present.

Sept. 29th.

The President, DR. HAYS, in the Chair.

Twenty-four members present.

Dr. D. G. Brinton was elected a member.

On favorable report of the Committee, the paper of Dr. Leidy, presented Sept. 15th, entitled "Extinct Mammalia of Dakota and Nebraska," etc., reported in favor of its publication in the Journal.

On favorable report of the Committees, the following papers were ordered to be printed:

Notice of American Species of PTYCHODUS.

BY JOSEPH LEIDY, M. D.

The Cestraciont genus of fishes Ptychodus, so far as known, is confined to the Cretaceous Formations. Remains, consisting of teeth, I have had the opportunity of inspecting from Alabama, Mississippi and Kansas, and although reported to exist in the Cretaceous Formation of Delaware, I have not met with them from that locality nor from the Green Sand, of corresponding age, of New Jersey. The following list comprises all the specimens of American Ptychodus teeth I have had the opportunity of examining.

PTYCHODUS MORTONI.

Agassiz, Poissons Fossiles III. (1833-43), 158, Tab. 25, figs. 1—3; copied in figs. 773, 773a, of Dana's Manual of Geology.

Palate bone of a fish? Morton: Syn. Org. Rem. Cret. Group. (1834), pl. xviii, figs. 1, 2.

The teeth of *Ptychodus Mortoni* I have seen only from the cretaceous formation of Alabama and Mississippi. Morton, in the work above noticed, figures a tooth, but does not mention the locality from which it was obtained.

Agassiz, in his Poissons Fossiles, gives a good representation of a tooth of this species, from the Green Sand of America, in three views, figs 1—3, Tab. 25.

Dixon, in his Geology of Sussex, represents two small teeth, (figs. 6, 7, pl. xxi), which he refers to the same species. Though exhibiting some resemblance in character to the American teeth, I think a further comparison is necessary to establish their specific identity.

The teeth of *Ptychodus Mortoni* are well defined in character, and in comparison with teeth of well recognized European species are almost generic in their peculiarity. Though exhibiting some variety, their likeness presents a distinct specific uniformity. Their size of course varies greatly with age and the relative position they occupied with one another in the mouth of the fish.

Viewed from above, the crown is reniform in outline, the long diameter being transverse; the incurvature posterior. The crown rises in the form of a cone with a more or less obtuse summit. The sides of the crown slope to the base and frequently more or less abruptly expand, laterally approaching the latter. The back part is occupied by a wide triangular sinus for the reception of the fore-part of the crown of the tooth which was situated in front of it when the teeth were contained within the mouth. The border of the crown is thick and rounded and dips beneath. At the sinus it is prominent. The summit of the crown presents a prominent crucial ridge, more or less distinct in different specimens. From the cross numerous ridges of about the same thickness diverge upon the sides of the cone, branching in their course, multiplying and becoming finer, and ultimately conjoining upon the base in a fine reticulation extending to the borders of the crown. The coarser ridges vary in their proportionate length in different specimens. The reticulation of the base is most extensive laterally, occupying usually half the breadth of the space between the summit and border. It also occupies the sinus, and is least developed at the fore-part of the crown. The width of the crown approaches double the fore and aft measurement, and the height is usually little less than the latter. The root partakes of the form of the outline of the base of the crown, but is more square and is flat or transversely concave below.

Twelve specimens of teeth of *Ptychodus Mortoni*, from the Cretaceous Formation of Alabama, belonging to the Yale College Museum, have been submitted to my examination by Mr. William M. Gabb. Among them occurs the largest tooth of the species I have seen, and larger than any on record. It is labelled as having been derived from Perry Co., Alabama. The fang and parts of the lateral and back borders of the crown are broken away. In the perfect condition the crown has measured a little over two inches in transverse diameter, one inch and a quarter antero-posteriorly, and ten lines in height. The crushing surface is porportionately less prominent at the centre than in the smaller teeth attributed to the same species, and is more uniformly convex, or less expanded laterally at the base. The borders of the posterior sinus also are less abrupt or defined. The unworn summit presents a crucial ridge, of which the lateral radii are most distinct and directed postero-laterally. From the crucial ridge, numerous ridges, equally prominent, diverge, branch in their course and ultimately conjoin in a fine reticulation at the base af the crown. This reticulation has the greatest breadth at the sides of the crown and is least developed at the fore-part.

Eleven teeth from Uniontown, Alabama, exhibit a gradation in size from less than three-fourths that of the above described specimen down to one little more than a fourth of its diameter. The specimens present a remarkable similitude throughout. Some are proportionately wider fore and aft than others, and the smallest are porportionately higher than the largest ones. The outline of the base of the crown is reniform, with the relation of the longer and shorter diameters varying. The largest specimen has the crown an inch and a half wide, a little over three-fourths of an inch fore and aft, and about half an inch in height. The sides of the crown expand at the base laterally; the fore-part forms nearly a uniform slope, and the back surface slopes to the sinus, which forms a broad triangular depression. The fang is fourteen lines wide, seven lines fore and aft, and three lines in depth.

The crown of a median sized tooth of the series, unworn, measures scant 14 lines wide, $7\frac{1}{2}$ fore and aft, and $6\frac{1}{2}$ high. The smallest specimen has the crown 7 lines wide. $4\frac{1}{2}$ fore and aft, and an equal height. Its base laterally appears more abruptly expanded than in the others. Most of the specimens are unworn and exhibit the characteristic ridges of the crown in a striking manner. In three specimens the coarser ridges are resolved into the reticulation much earlier or nearer the summit than in the others. In one specimen the crown is smooth or totally devoid of ridges, presenting the same appearance represented in figs. 4, 5, pl. xxx, of Dixon's Geology of Sussex, and described as "nascent or incomplete teeth of *Ptychodus*.

Seven specimens of teeth in the Museum of the Academy, from Alabama, exhibit the same characters expressed in the description of those above. They all present an unmistakeable specific likeness, though varying in the proportions of their diameter. The largest specimen has the crown 16 lines wide, 11 lines fore and aft, and 8 lines high. The root is an inch wide, 7 lines fore and aft and nearly 3 lines thick. A second specimen, with the crown 16 lines wide and 9 lines fore and aft, has been proportionately lower than the former. Its summit is worn away, leaving an exposed circular disk of vaso-dentine 4 lines in diameter.

Two specimens in the Museum of the Academy, presented by Prof. Joseph Jones, are from Green Co., Alabama. The larger is perfect and unworn. The crown is scant 14 lines wide, by 7 lines fore and aft, and 5 lines high. The root is $11\frac{1}{2}$ lines wide, $4\frac{1}{2}$ fore and aft, and 2 lines thick.

Two specimens in the Museum of the Academy, presented by Dr. Wm. Spillman, are from Columbus, Mississippi. They present the same character as the Alabama specimens. The larger specimen has the crown 20 lines wide, 10 lines fore and aft, and has perhaps been about 8 lines high. The summit is worn off, leaving an exposed flat circular surface of vaso-dentine half an inch in diameter. The root is 15 lines wide, 6 lines fore and aft, and three lines thick. The smaller specimen consists of an unworn crown 11½ lines wide, 7 lines fore and aft and 5½ lines high.

PTYCHODUS OCCIDENTALIS, n. s.

The Museum of the Academy contains a specimen consisting of the crown of a tooth of a species of *Ptychodus* differing from any other previously known. It was obtained by Dr. John L. LeConte, in association with other remains of fishes, from an ash-colored rock of the Cretaceous series, a few miles east of Fort Hays, Kansas.

The tooth is remarkable, especially from the comparatively near approximation of its diameters, the width transversely and fore and aft and the height approaching one another more nearly than in any other species. The fore-part of the crown is somewhat injured and the root is broken away. The transverse diameter of the crown at base is 14 lines; the fore and aft diameter has been about an inch; and the height is also an inch.

In shape the crown is a blunt cone with the sides sloping evenly to the base and to the posterior sinus. The latter is a triangular concavity about two-thirds of the breadth in height.

The direction and arrangement of the ridges of the crown are much like as in the European *Ptychodus decurrens*, but the principal ridges crossing the crown transversely are finer and the intervals much narrower, indeed the space occupied by a pair of ridges with their interval in *P. decurrens* would accommodate three ridges with a pair of intervals in *P. occidentalis*. Descending the sides of the cone the ridges branch as in *P. Mortoni*, and at the basal half of the crown form a reticulation much as in *P. decurrens*. At the back of the summit of the crown the principal ridges continue their transverse or parallel course until near the upper part of the sinus, into which as they descend they are resolved into a fine reticulation. The fore-part of the crown is occupied by a reticulation formed by the descent, convergence and division of the more anterior principal ridges.

From the description it will be observed that the tooth holds an intermediate position in anatomical character to those of *Ptychodus Mortoni*, and *P. decurrens*.

Three small teeth, found by Dr. Le Conte in association with the latter, resemble, in their proportions and in the proportionate size and arrangement of the ridges of the crown, the teeth of *P. decurrens*, but perhaps may belong to the same species as the large tooth above described. The larger of the three specimens is perfect, but has the summit of its crown worn off. The crown measures 7 lines transversely, 6 lines fore and aft, and has been from 4 to 5 lines high. The root is 6 lines wide, 4½ lines fore and aft, and 2¼ lines thick. Comparatively coarse ridges cross the crown transversely, curving forward laterally and ending in a marginal reticulation. Branching ridges descend in front from the foremost of the transverse ridges, and likewise end in a marginal reticulation. The sinus is occupied by a finer reticulation joined by fine ridges descending from the summit and sides of the crown. The smallest tooth, likewise perfect, has the crown 4½ lines wide, 3½ lines fore and aft, and 2½ lines high.

Three additional specimens associated with the former ones, are the smallest teeth of *Ptychodus* I have seen, but I suspect that they belong to the same species. They are transversely ellipsoidal in outline at the base of the crown. and this appears as a low cone elevated at the inner third and with a broad expanding base. The sinus is situated at the inner posterior third. The surface of the crown is crossed with transverse ridges which form a narrow reticulation at the border. The largest of these small specimens is 3⅓ lines transversely, 1¾ fore and aft, and ¾ of a line high from the root. The smallest tooth is 2¼ lines wide, 1½ fore and aft, and ½ a line from the root.

PTYCHODUS POLYGYRUS.

Agassiz: Poissons Fossiles III, 156; Dixon: Geology of Sussex, 1850, 363. Gibbes: Jour. Acad. Nat. Sci., 1849, 299, pl. 42, figs. 5, 6.

Dr. Gibbes, in the work above noticed, figures two teeth, from the cretaceous formation of Alabama, which he refers to *Ptychodus polygyrus*. They clearly bear a close likeness to specimens of the European species of that name.

A single specimen of a tooth, accompanying the Alabama specimens belonging to the Yale College collection, resembles the teeth of the European *Ptychodus polygyrus*. The crown is nearly square or transversely oblong, with the fore and back borders nearly straight, and the lateral borders convex. The crushing surface is moderately convex and is crossed transversely by ten coarse acute ridges, separated by similar intervals. The borders of the surface, including the posterior sinus, are occupied by comparatively fine vermicular and interrupted ridges, appearing like granulations. The coarse ridges are nearly straight, and at the end rather abruptly resolve themselves into the finer vermicular ridges of the border. From European specimens of the teeth of *P. polygyrus* and *P. latissimus*, this tooth appears especially to differ in the proportionately greater degree of fineness of the bordering vermicular ridges or granulations of the crown. Its measurements are as follows:

Width of crown 13 lines; fore and aft 11 lines; height 5½ lines; width of fang 8 lines; fore and aft 6½ lines; thickness 3 lines.

Of other species of *Ptychodus*, Agassiz mentions teeth of *P. mammillaris*, found in the excavation of the Delaware canal, and preserved in the Museum at Paris. (Pois. Fos. III, 151.) I have seen no specimens of that species from an American locality.

Synopsis of the Extinct BATRACHIA of North America.

BY EDWARD D. COPE, A.M.

BATRACHIA.

The vomer is double, and usually bears teeth in this class; the premaxillary is usually double; Amphiuma and Spelerpes b e l i i are exceptions. Teeth never planted in deep alveoli.

There are six orders, as follows:

TRACHYSTOMATA.

Caudal vertebræ and frontal bones distinct.

Inferior pelvic elements not confluent.

O. o. maxillaria, prefrontalia, palatina and pterygoidea wanting; nasalia present.

Ethmoid,* two lateral pieces, each forming part of palate.

Mandible toothless, condyloid.

No "postorbital and supertemporal bones."

First pair ceratohyals distinct.

PROTEIDA.

Caudal vertebræ and frontal bones distinct.

Inferior pelvic elements not confluent.

O. o. maxillaria, prefrontalia and nasalia wanting; palatina and pterygoidea present.

Ethmoid,* a vertical plate on each side the cerebral lobes.

Mandible toothed, teeth pleurodont.†

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* Erroneously called orbitosphenoids by me, Jour. Acad. 1866 (on Anura).

† The statement made by Dr Gray that the teeth of Necturus are canaled, as in venemous serpents, by a channel entering at the base and issuing below the tip, appears to the writer to be of doubtful accuracy. No other opening exists in the teeth of Necturus ma-

Ceratohyals, first pair connate.
No postorbital and supertemporal bones.

Urodela.

Usual cranial bones present, but pterygoids reduced or wanting.
No "postorbital or supertemporal bones."
Caudal vertebræ and frontal bones distinct.
Ethmoid a vertical plate on each side.
Mandible dentigerous, teeth pleurodont.
Inferior pelvic elements horizontal, in contact, no osseous pubis; ilium suspended to a sacral rib.
(Mostly no quadratojugal.)

Gymnophidia.

Usual cranial bones present and distinct, including frontals and pterygoids.
Caudal vertebræ distinct.
No "postorbital or supertemporal bones."*
Ethmoid an annulus surrounding cerebral lobes.
Mandible dentigerous; teeth anchylosed by their bases.†
(A quadratojugal.)

Stegocephali.

Usual cranial elements distinct, including frontals and pterygoids, and adding "postorbitals and supertemporals."
Caudal vertebræ ?
Ethmoid normal.
Inferior pelvic elements distinct.
Mandible dentigerous; teeth with anchylosed bases, or
(A quadrato-jugal.)

Anura.

Frontal and parietal confluent, nasals wanting or rudimental; other cranial bones present.
Postorbital, supratemporal and usually nasals wanting.
Ethmoid an annulus (usually complete above) surrounding cerebral lobes.
Caudal vertebræ represented by an elongate compound style.
Inferior elements of the pelvis consolidated into a single vertical mass; ilium attached immediately to sacral vertebra.
Quadratojugal.

STEGOCEPHALI.

Xenorhachia.

The vertebral centra not ossified; ? the dentition pleurodont; teeth simple; ? no branchial hyal bones. ? Occipital condyles.

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culatus than the emargination at the base of the root occupied by the growing crown of the successional tooth, as in other Batrachia. If the structure described by Dr. Gray exists, it is in a species as yet unexamined by American zoologists. Professor Winchell, of Ann Arbor, confirms my observation.

In my Synopsis of higher groups of Batrachia (Journ. Acad Nat. Sci. 1866), I stated that Amphiuma possesses minute scales. Gray, in 1850 (Catalogue Brit. Mus.), makes the same statement, which Duméril (1863. Catal. Mus. Paris) contradicts. I must accord with Prof. Duméril, since a subsequent examination has convinced me that they do not exist. The specimen in which the appearance of scales was presented was mislaid at the time of writing, and I find it was due to numerous free portions of the true derm, which are continuous with the attached portions.

* When the temporal fossa is overarched it is by expansion of the maxillary and quadratojugal. (Stannius says "squama temporalis.")

† The teeth of Cæcilia are compressed with a trenchant posterior edge, which is crenate, after the manner of Megalosaurus, Carcharias, etc. Thus to the numerous genera of Saurians and Selachians possessing this character, must be added a Batrachian.

MICROSAURIA.

Vertebral centra ossified; no branchial hyoids; teeth simple or with slightly inflected enamel, pleurodont. Occipital condyles.

GANOCEPHALA.

Vertebral centra cartilaginous; branchial hyoids present; teeth with slightly inflected enamel, anchylosed by their bases. No ossified occipital condyles.

LABYRINTHODONTIA vera.

Vertebral centra osseous; no branchial hyoids; teeth with much inflected enamel, anchylosed by their bases. Occipital condyles.

XENORHACHIA.

This order I proposed for the reception of the genus Amphibamus Cope, in 1865. I proposed to regard, as one of its characters, the existence of opisthocœlian vertebræ. Such impressions were observed in the matrix in which the fossil was preserved, as to induce a belief in the existence of such vertebræ, and the existence of these in a well ossified condition, in the apparently nearly allied genus Pelion Wyman, strengthened such belief. There were actually, however, only osseous neural arches present, and I am now decidedly of the opinion that the vertebral centra were either cartilaginous or annuliform, as in Archegosaurus.

AMPHIBAMUS Cope.

Proc. Acad. Nat. Sci. Phila. 1865, 134.

AMPHIBAMUS GRANDICEPS Cope, Proc. Ac. N. Sci. Phila. 1865, p. 134. Palæontology Ill. State Survey. Tab.
Carboniferous; Lower Coal Measures, Morris Co., Illinois.

MICROSAURIA.

This sub-order was established by Prof. Dawson, for small lizard-like vertebrates from the Coal Measures, which he thought presented points of affinity to, or should be under the Saurian reptiles, at the same time recognizing Batrachian characteristics.

After examining the evidence brought forward by Prof. Dawson, it appears to the writer that the Saurian characteristics are analogical only, and not indicative of true affinity, and that these creatures form, in fact, a series closely resembling or parallel with what was probably an immature stage of the Labyrinthodontia. They are in fact Labyrinthodonts, with simple or very slightly inflected enamel of the teeth, and with the extent of the exostosis of the cranial bones much reduced. This character has been much overrated by some authors. In the Dendrerpeton obtusum Cope the grooving and pitting exists only on the posterior parts of the cranium, and gradually disappears anteriorly. In the Alligator mississippiensis the same is the case.

The points in which they have been said to resemble the Lacertilia, are, 1st, the dermal scales; 2d, the parietal fontanelle; 3d, possession of ribs. All of these features belong to the Labyrinthodontia; the Xenorhachia also had scales. On the other hand, the two occipital condyles, indicating the existence of a parasphenoid bone, distinguishes it at once from all the Allantoid vertebrata, and the form of the vertebræ is very Batrachian. In the Lacertilian families of Gecconidæ and Hatteriidæ only we have biconcave vertebræ, but the concavities are comparatively shallow, and the vertebræ less constricted medially than in the Microsauria. Those of the latter are much like those of Salamanders, according to Prof. Dawson's figures.

The bones figured as pelvic are unlike those of any Batrachia or Lacertilia known to the writer. But until those of the Labyrinthodontia are discovered, we cannot assert that they differ from the latter. The long spatuliform elements figured as pelvic are, perhaps, scapulæ, which are of not very different type in the Trachystomata, Proteida, and the Ganocephala.

The only species included in this tribe in which inflections of the enamel have been described, is the Dendrerpeton acadianum, and here it is only at the base. It is, however, not impossible that this genus should not be associated with Hylerpeton, Oestocephalus, etc. The genera Urocordylus, Ceraterpeton, Lepterpeton, Ophiderpeton and others recently described by Prof. Huxley, also belong here.

PELION Wyman.

In litteris. *Raniceps* Wyman, Amer. Jour. Sci. Arts, 1858, 158. Not of Cuvier (Pediculati).

PELION LYELLII Wyman. *Raniceps lyellii* Wyman, l. c.

This animal differs from the genus Amphibamus in the well-ossified vertebral axis; no remains of a tail with elevated neural spines exist in the type specimen, and no ventral scales are seen in it.

Middle Coal Measures, Jefferson Co., Eastern Ohio.

HYLONOMUS Dawson.

HYLONOMUS LYELLII Dawson, loc. cit. viii, 167.

The Joggins. Nova Scotia Coal Measures.

HYLONOMUS ACIEDENTATUS Dawson, l. c. viii, 258.

Coal Measures; with the last.

HYLONOMUS WYMANII Dawson l. c. viii, 270.

Coal Measures, Nova Scotia; with the last.

PARIOSTEGUS Cope.

This genus is represented by a large part of the cranium of a Batrachian from the triassic coal measures of Chatham Co., North Carolina. If not a Batrachian, it could only belong to a ganoid fish, but though some of its characters are somewhat ichthyic, it lacks the following important elements of the ganoid structure, i. e., free post- and suborbital bones; postnareal cavities; branchiostegal, and arched branchihyal bones. On the other hand it has a large preorbital, bounding the frontal and maxillary to the nares, and the inner border of the orbit as in Stegocephalous Batrachia; also a postorbital element contributing to the formation of an extended supratemporal roof.

Contrary to what has been found the case in most genera of Stegocephali, the maxillary appears to extend posteriorly to a free termination, as in modern Salamanders, and the supra-temporal bone presents a very prominent, obtuse, arched margin. This margin extends from the orbits on each side, and is incurved towards the posterior part of the cranium. There is therefore no quadratojugal piece.

The maxillary and mandibular pieces are slender, flat bones, as in Menopoma; the form of the posterior or articular portion of the latter cannot be ascertained from the specimen. The more or less exposed part of the median region of the latter exhibits a succession of shallow transverse notches, enclosing thirteen obtuse elevations. The former resemble rudimental lateral alveolæ for minute pleurodont teeth. A few other similar minute ribs, and perhaps a minute curved cone without sculpture, are the only other indications of dentition.

The bones of the upper surface of the cranium are most readily interpreted by reference to those of Menopoma. A pair of narrow nasals, acuminate behind, penetrate between the frontals as far posteriorly as the posterior margins of the orbits. The suture between these is very distinct, and entirely straight. The preorbitals extend to above the orbits, and there appear to cease with a transverse suture. Between these and the nasals a broad triangular element enters on each side, not attaining the probable position of the nostrils. Each is divided by a longitudinal groove, which is probably a suture, and which would then divide the frontals from the parietals. The frontals would then divide the parietals entirely, as they do in Menopoma for the anterior half of their length. This would give the frontals a narrow form, acuminate in front, and bounded behind by a regular coarse, zig-zag transverse suture. The cranium behind this point is rugose, and the surface not well preserved, and it can only be said that two irregular grooves converge to a point between the posterior extremities of the frontals, like the boundaries of the supraoccipital. The posterior boundary of the cranium with the condyles cannot be readily determined. When the postorbital roof bone is raised up, the meeting of two gular dermal bones, as I interpret them, is seen. One of these is a plate directed backwards and outwards, bearing minute radiating lines on its upper surface. It meets a similar flat plate directed forwards and outwards, with similar lines radiating to the circumference. The inner margins of these plates were not seen.

The orbits are remarkably small, and situated probably near the middle of the longitudinal measurement of the cranium. The external nares are not defined, but symmetrical depressions in the position they usually occupy in Salamanders are distinct.

The general form recalls Menopoma, particularly the necessarily small eyes. A slender curved bone with a slightly dilated and truncate extremity, lying by the cranium in connection with the mandible, is like a branchihyal of that genus. Nevertheless it cannot be positively assigned to this genus, as numerous scales of cycloid fishes are on the same block.

Pariostegus myops Cope.

The surfaces of the cranial bones are little sculptured; there are small tuberculiform elevations on the parietals and more numerous ones on the preorbitals. The postorbitals show the strongest markings of elongate pits which radiate to their circumference, leaving a smooth obtuse border. The nasals present a series of small warts at a little distance on each side of their common suture, and transverse to it. The surface of the maxillary is marked with longitudional grooves and shallow pits.

No suture separating maxillaries and premaxillaries can be traced with certainty, though the bones of the jaw are interrupted at the usual place of suture, opposite the nostril.

Measurements.

	Lin.
Length of specimen (including mandible)	18
Width between outer convexities postorbitals	17
" " inner borders orbits	11
" of same without preorbitals	8
" of nasals at middle	2·5
" orbit	1·5
Length of frontal nasal premaxillary	11.
" " supposed branchihyal	12.

The name is derived from the roof-like postorbitals with free lateral margin.

Locality.—Coal bed of the Keuper Triassic, Chatham Co., North Carolina. The species was discovered by Prof. Jos. Leidy, who handed it to me for description. It is in the Museum of the Academy of Nat. Sciences of this city.

DENDRERPETON Owen.

Journal Geol. Soc. London, 1853, p. 81.

In the form of the cranium this genus differs from Brachydectes and Ophiderpeton, much as Menopoma does from Amphiuma. Two species appear to have left their remains in the coal measures at Linton, Ohio.

DENDRERPETON OBTUSUM Cope.

This species is known by a partially preserved cranium. The superior surface is exposed, the outlines of the jaws and orbits are well preserved, with the occipital condyles. The os-quadratum is directed obliquely backwards, and the angle of the mandible extends to a line a little behind that of the occipital condyles. The zygomatic arch exists in a position similar to that in which it may be seen in a few genera of Anura, as Discoglossus and Pelobates. It extends downwards and forwards from the suprasquamosal to the maxillary region, but whether it is homologically squamosal or malar, the specimen cannot show. The postorbital is present as well, and with the last, and the supratemporal forms the bony roof of the temporal fossa. A piece which may be the pre- and postfrontals combined, borders the inner superior margin of the orbit; it widens posteriorly, where it has contact with the parietal, etc., and narrows in front. Supra-occipitals form together a broad triangle on the upper plane of the cranium, of less extent than the adjoining supratemporal. The latter elements are pitted, and towards their margins radiate grooved. These sculpturings grow less on the margins of the supratemporal, and the portions of the surface of the more anterior element remaining are so slightly marked as to give the impression that the sculpturing in this species is much less than in others of the genus. A few beaded ridges are all that remain on a few of the parietals and postorbitals; the maxillaries have a slightly stronger sculpture seen in a few spots.

The general form of skull is elongate behind, and much shortened in front of the orbits. The orbits are thus altogether in front of a line equally dividing the cranium transversely, while in the D. acadianum Ow. they are in the middle of the skull. The outline of the muzzle in one species is thin, broad, rounded, as in the Menopoma alleghaniensis, while in the latter it is ovate and produced.

The parietal bones extend to opposite the posterior margins of the orbits, are then gradually contracted and form an acuminate prolongation on each side the wedge-shaped frontals. The prefrontals are thickened on each side the front, behind the external nares. The sutures defining the frontals anteriorly, the nasals, and the premaxillaries behind, cannot be made out. The median longitudinal suture is a marked and zigzag one, and can be seen as far posteriorly as the anterior margin of the orbits. The external nostrils are large and opposite the inner margin of the orbit on each side. This separation of the nares is associated with a greater transverse extent of the premaxillaries than in some of the genera. These have been set with numerous teeth, judging by their small impressions; no larger ones have left traces, and no traces of any on the maxillaries. The teeth of the genera before described are all much larger relatively, indicating still further the diversity between them.

A fragment of mandible remains, but without teeth or external surface. It shows a large internal canal.

Measurements.

	Lines.
Total length cranium	25·5
Width cranium 3 lines behind orbits	24
" between orbits	7·5
" " nares	5·
" " occipital condyles	2·2
" of supraoccipital bones	6
" of right parietal	6
Extent of premaxillaries	8·7
Length orbit	6

From the Coal Measures at Linton, Columbiana Co., Ohio, (West Pennsylvania Basin). Discovered by Dr. John S. Newberry.

Another cranium accompanies the collection which belongs to a species distinct from the last. The muzzle is not so broadly rounded, and the premaxillary teeth are relatively much larger. The sculpture is more delicate, with the ridges more acute. The orbits and nares are not defined. The maxillary is well preserved for a length of an inch; its teeth are smaller than the premaxillaries; I count four in a line; crown simple conic. External surface of maxillary not very strongly sculptured.

This species cannot be referred to its genus without further material. I therefore do not name it, hoping to avoid the unworthy practice of some, who give *prospective* names—to be applied to other peoples future discoveries, and the like.

Dendrerpeton acadianum Owen, Quart. Journ. Geol. Soc., x, 1853, 81. Dawson loc. cit.
Coal Measures: Joggins of Nova Scotia.

Dendrerpeton owenii Dawson, Canadian Naturalist and Geologist, viii, 161.
Coal Measures: as the last.

HYLERPETON Owen.

Hylerpeton dawsoni Owen, Journ. Geol. Soc. Lond., 1862, 241. Dawson, Canadian Naturalist and Geologist, viii, 272.
Carboniferous Coal Measures. The Joggins, Nova Scotia.

BRACHYDECTES Cope.

This genus is indicated by two rami of a mandible, and a portion of a premaxillary only. These, when compared with those of Oestocephalus and Dendrerpeton from the same locality, and with others described by authors, are so much stouter, *i. e.* shorter and more elevated, that they evidently pertained to a genus not hitherto known. The genus further differs from Oestocephalus in having the teeth of equal size to the posterior parts of the series, that is to the base of the elevated coronoid process. The teeth are elongate cylindric cones, with their acute tips turned a little posteriorly. The fractured ones display a large pulp cavity. The three premaxillaries preserved are similar but without curvature of the tips. They do not exhibit striæ or any other sculpture. So far as the remains known go, the genus is nearer Hylerpeton than any other. The latter does not give any indication of the very elevated coronoid process of Brachydectes, though the external portion of the dental bone in that region being lost, little can be said about it. Prof. Owen's plate indicates a ramus whose depth at the last tooth enters $8\frac{1}{2}$ times the total length. In our species this depth enters about five times. There are at least nine teeth in the Nova Scotian species; seven in the present one.

Brachydectes newberryi Cope.

This species is represented by one nearly perfect ramus mandibuli, one dentary bone, and one premaxillary probably not complete.

The dentary bone appears to have been attached by suture to the articular and angular, as its free margin has very much the outline of that suture in Amphiuma and lizards. The coronoid process would also seem to be a part of the same bone as in Amphiuma and Menopoma, and not composed of a coronoid bone as in lizards. It rises immediately behind the last tooth, and displays no suture.

The lower portion of the dentary is prolonged into an acute angle. This is separated by a deep and wide concavity from the superior posterior prolongation, which is obtuse and rises at once into the coronoid process. Teeth on this dentary seven; the same number is on the preserved ramus; this number I suspect to be complete or nearly so. The teeth terminate at the obvious termination of each ramus, which is it is true slightly obscured. The teeth are the longest of the Microsauria in relation to the depth of the ramus, equalling the largest in Ophiderpeton. They are doubtless exposed, as are some of those of the last named genus, by the splitting away of the outer parapet of the dentary bone. As no traces of alveoli have been thus rendered visible, I suspect the dentition to have been pleurodont, as in existing Batrachia.

No external surface of the mandible remains, but there are no impressions of sculpture on the matrix. A little external face of the premaxillary displays none.

Measurements.

	Lines.
Preserved length of ramus (imperfect)..	11.
Depth at last tooth.........	2.
Length of exposed tooth...	1·7
" dentary......	7·5
Depth at coronoid......................	3·5
" at first tooth	1·3

SAUROPLEURA Cope.

Neural and haemal elements of the caudal vertebræ elongate, distally dilated and grooved, attached by contracted bases. Ventral aspect defended by a series of oblique dermal ribs on each side, which meet anteriorly on the median line. Limbs distinctly developed. Ribs long, well developed. Scales none.

No dermal bones have been discovered, nor are any portions of the cranium known.

This genus is allied to the Urocordylus of Huxley, recently discovered in the coal measures in Leinster, Ireland. It differs only in the presence of elongate lizard-like ribs (whence the name), and in the absence of "oat-shaped scales" of the upper surfaces.

It is a matter of much interest in American palæontology that this remarkable type should be found to occur in our coal measures. It was first announced by Dr. Newberry at the meeting of the American Association for the advancement of Science for 1867 (see Proceedings, p. 144), as a supposed Urocordylus, occurring with Ophiderpeton. He mentioned at the same time the discovery of the ganoid Dinichthys Newb.

The forms discovered by Dr. Newberry have an interesting relation to those of Ireland, such as types of the present period frequently present.

The genera may be thus parallelized; where no representation exists, we may look forward to a future discovery to supply the present want:

Ceraterpeton Huxl.,	represented	by	
Urocordylus Huxl.,	"	"	Sauropleura Cope.
Lepterpeton Huxl.,	"	"	
Dolichosoma Huxl.,	"	"	Molgophis Cope.
Ophiderpeton Huxl.,	"	"	Oestocephalus Cope.
			Brachydectes Cope.
Herpetocephalus Huxl.,	?	?	Dendrerpeton Ow.

Of the American genera, Sauropleura and Oestocephalus exhibit the peculiar ventral dermal armature of Urocordylus and Ophiderpeton, while Molgophis does not possess it, nor Dendrerpeton, if our species truly belongs there.

The museum of Columbia College, New York, contains portions of two species of Sauropleura, but both unfortunately represented by portions only of the vertebral column. These are, though closely resembling the species described by Prof. Huxley, sufficient to demonstrate marked generic distinction. This is further established by the remains of the trunk of a third, and larger species, whose relationships can be shown to lie within this genus. This individual has been spread over a surface of the coal slate, exhibiting ventral armature, dorsal region with ribs, and anterior and posterior limbs. Of skull and caudal vertebræ nothing remains.

The dermal riblets are arranged as in Urocordylus, *i. e.*, in parallel lines directed obliquely forwards and continuous on the median line, forming there a chevron, directed forwards. The striæ are not so closely placed as in U. pectinatus, but are separated by grooves wider than themselves.

The humerus, ulna, and radius are rather stout, and of a size relative to the body, as in common types of existing Sauria; the ulna and radius separate. There is no carpus, but five well-developed digits have phalanges in the following numbers, commencing on the inside: 3—4—5—6—5. The last phalange of the second is obscured, and it is not positive that the number is as given; it is more probable than that it should have been 3. The outer toe has been more slender than the others; the distal phalanges of all the toes are short conic, as in Salamanders. Thus this form differs much from Amphibamus, where the numbers are 3—3—4—5—4, showing a lower developement of limbs.

The ribs are long and curved, as in Reptiles, and judging by their distances the vertebræ are short; the latter are not well defined, but there is no indication of prominent spines of any kind.

The pelvic bones and portions of those of the hind limbs are present, but so obscure and confused as not to be made out. Enough remains to show that the hind limbs are considerably larger than the anterior.

SAUROPLEURA DIGITATA Cope.

This species had a length of body about equal to that of a fully-grown Chamæleo vulgaris of the largest size, or of a half-grown Menopoma. Thirteen ribs on one, and several on the other side, are preserved; where they terminate, probably at the pelvic region, some small or rudimental ribs project from the two or three first caudals. Three ribs and their interspaces extend over five lines. The humerus is broken, but its length can be clearly made out to be seven lines; it has no condyle, and is dilated at both extremities. The ulna and radius are distinct, truncate, hollow, and dilated at the ends. Length of ulna 5·4 lines, distal width 1·8 lines. Carpus not ossified. The fourth toe is considerably longer than the others, the fifth is next, and reaches the basal third of the antepenult phalange of the fourth; the third is very little shorter; the first is not quite so long as the first two of the third. The bones of the hind limb are not readily distinguished. They are evidently much longer and larger than the anterior; no part of a foot is preserved.

This form is probably allied to Urocordylus. It has relatively much stronger ribs in relation to the vertebræ than we have seen in that genus, and there is no evidence of the existence of the peculiarly formed spines of the vertebræ characterizing the latter. The limbs are relatively much stronger than in Ophiderpeton, and it lacks the peculiar dermal armature of that genus.

SAUROPLEURA PECTINATA Cope.

This species is represented by portions of the vertebral columns of four individuals. In two of these, vertebral centra are discoverable; in one quite definitely. They are slightly constricted medially, and without ridge or process.

The neural and hæmal spines of superior and inferior lines are similar, and in the specimens undistinguishable. The dilated portions form nearly equilateral triangles, which stand on moderately short pedicels. They are weakly ridged, and each ridge is prolonged into a narrow acute tooth, beyond the margin, of which eleven may be counted on one of the best preserved. The longitudinal striæ are terminated near the pedicel by two others, which cross obliquely from each side, and, meeting, present an appearance similar to an overlapping of each margin. The edges of the spines form a continuous line.

As in the other species, there are no indications of other processes, nor of dermal scales.

The smallest of the specimens shows that in front of the region furnished with the peculiar spines described, the body is furnished with a mass of bristle- or hair-like scales. The grooved neural spines are slightly displaced anteriorly, and the bristle-like mass looks like a continuation of their striæ, and it is not easy to find any line of demarkation between them. The serrate spines are continued further forward on one side than the other. These linear scales were arranged as in other genera, in lines which converge forwards to the median line. They are somewhat obscured in the specimen, but it can be determined that they are continuous on the median line. Whether this is the posterior or anterior portion of the body cannot positively be determined from the specimen; it is, however, most likely the posterior, for near the posterior portion of the striate surface a weak pair of limbs is given off on each side. On the right, a moderately stout ? femur is followed by a broken tibia and fibula, and by five slender, closely appressed metatarsals. The last are about two-fifths as long as the space between them and the femur; beyond them a few slender phalanges are moderately distinctly defined. The tibia is more distinct on the left, but no tarsus or phalanges; some of the metatarsals are preserved here also. Length of limb to end of metatarsals equal to five vertebræ in juxtaposition, measured along the edges of the neural spines. The limb has been slender, especially the hand.

The above specimen enables me to assign, as the ventral armature of this species, a closely packed series of V-shaped grooves, which lie in connection with an obscure vertebral column, on the block containing one of the typical specimens of this species. They are not continuous with any of the series exhibited on other parts of the block; some of these at least are the doublings of the slender animal, and this ventral portion has been displaced. The grooves are perhaps the impressions of hæmapophysial rods, vastly more numerous, however, than the number of vertebræ; perhaps they are rather the dermal armature. Huxley figures a portion of this as on the block with Urocordylus wandesfordii, but does not refer it to its precise relation to the animal. A few well-developed ribs are preserved with this portion,—the only ones I can refer to this species. The vertebræ are partly enclosed in matrix, partly impressions. The neural spines, though expanded antero-posteriorly, are less elevated than in the caudal region, and have left no traces of their characteristic ribs or serration.

The number of spines in the type specimens is six in a half-inch; in the smallest, just described, ten in the same distance. The height of the spine in the former is 1·15 lines.

As the characters of this species are most determinable, I regard it as the type of the genus Sauropleura.

Sauropleura remex Cope.

This species is larger than the S. pectinata, and about equal to the Urocordylus wandesfordii Huxl. The caudal spines differ from both in the greater attenuation of the haemal series, and the presence of a basal lamina on the neural.

It is represented by a portion of the vertebral column three inches in length. In this space may be counted twenty-four vertebræ Such of the latter whose outlines are visible display centra, characteristic of the genus; their terminal concavities conic, with apices meeting medially; zygapophyses present; and their length a little greater than their depth.

The characteristics of the species are the remarkable length and slenderness of the fan-shaped neural and haemal spines, and the absence of an acute serration on their margins. In this species the spines have a laminiform expansion at the base in their planes. In the other species here described these spines are not only relatively broader and more fan-shaped, but they are acutely serrate on the margin and constricted at the base.

In S remex the dilated neural spines are a little more than three times as long as they are distally wide, while the hæmal spines are a little narrower. The neural spines stand about the middle of the centrum. The basal half is furnished with an anterior ala, which leaves the anterior margin rather abruptly and extends to the next spine in advance. It returns gradually to the centrum and is separated from the articular face of the latter by a notch. A similar ala exists on the posterior margin of the neural spine, which extends for a shorter distance above the base, and is narrower than the anterior. Each spine presents a median groove on its surface, which extends half way to the base or further; on each side of this are some three other grooves, which extend but a short distance; surface otherwise smooth. The ends of the grooves slightly notch the truncated end of the spine.

The hæmal spines are on the posterior portions of the centra, and in contact with the anterior part of the basis of those succeeding. They are without the dilatations of the neural spines, and are directed rather more obliquely backwards. They are similarly grooved, though without that so distinctly median, seen in the neural series.

Both neural and hæmal spines become larger towards the posterior part of the vertebral column. There appear to be no zygapophyses nor diapophyses, nor rudiments of ribs. The centra are rather stout, and somewhat constricted medially. There are no traces of dermal armature of any kind.

Measurements.

	Lines.
Length of a posterior centrum	1·2
Depth " " "	1·
Length neural spine of adjoining vertebra	4·4
Basal width	1·4
Median width	·9
Distal width	1·1
Length of a more anterior neural spine	4·3
Distal width " " " "	1·5
" anterior hæmal spine	4
" width " "	1·4

From the Coal Measures, the Western Pennsylvania and Ohio Bituminous Basin, at Linton, Columbiana Co., Ohio, near the Ohio River. Prof. J. S. Newberry.

ŒSTOCEPHALUS Cope.

This genus is known from a single species as yet. As before remarked, it represents in many respects the Ophiderpeton of Huxley, and has been alluded to by Dr. Newberry as the same. It, however, differs markedly in the narrow lanceolate form of the head, with probable accompanying peculiarities of detail, and in the presence of limbs, which have not been found in the Irish genus. The form of the head is somewhat nearer that of Lepterpeton Huxl., but the limbs of the American genus have as yet been seen as one pair only, and very small, while in Lepterpeton there are two pairs, which are large. The general form of the body of Oestocephalus is more snake-like.

In more detail, we have an elongate lanceolate head with little or no sculpturing of the external surface of the bones. The angles of the mandibles are much prolonged backwards as in Archegosaurus and frogs, and the well developed ribs commence but a short distance behind the head. The vertebræ are slender, and furnished with well developed diapophyses. A pair of symmetrical bones, whose impressions are seen posterior to the occipital region, look like ceratohyals or small scapulæ, and one of them is continuous with a second piece, which occupies the place of a humerus A third piece follows, which is probably ulna; no radius or manus is preserved. This then is a rudimental fore limb, situate very close to the head. The skin has been occupied by a great number of closely packed, curved, spine-shaped scales. They have occupied the ventral integument passing from the median line of the belly outwards and posteriorly, having acute tips which may have penetrated the skin on each side; whether such tegumentary spines protected the back cannot now be determined.

OESTOCEPHALUS AMPHIUMINUS Cope.

This species is represented by the imperfect crania and anterior portions of the bodies of two individuals. They indicate an animal of the average size of the Amphiuma means.

The extremities of the vertebræ are deeply concave, but the centra are so long as to prevent the concavities entering more than one-fifth of the latter, each. The diapophyses are behind the middle, and are broad, curved backwards, and acuminate, as in Amphiuma. The centra have a prominent median line below, with a longitudinal concavity on each side. Five of them a little exceed an inch in length. Neural spines are nowhere visible. The humerus is longer than the scapula and is considerably dilated distally; the scapula slightly dilated at its superior extremity.

The dermal armature commences immediately behind the head, and forms a band of 14 lines in width; measuring across the spine-like scales, in a width of a line, four cylinders may be counted. The external portions are carried backwards, the interior nearly straight, those of the anterior more delicate than the posterior.

The head is wedge-shaped with regularly acuminate sides. The top of the cranium is somewhat broken in the specimen; the portions preserved are smooth, and the longitudinal suture is distinct for a considerable distance. The angle of the mandible is produced considerably behind the occiput and is enlarged and rounded. The end of the muzzle is broken away, and the region of the orbits so fractured as to render their precise location uncertain. The superficial layer of the cranial bones is nowhere clearly visible, so that it cannot be ascertained whether it is sculptured or not. The quadrate bone projects well posteriorly. Some fragments indicate small cylindric teeth, as in Amphibamus, but they are not characteristic.

Measurements.

	Lines.
Length cranium without muzzle	17·3
Width " posteriorly	11·5
Length scapula	2·1
" humerus	2·5
" of sixth vertebra from skull	3
Extent diapophyses	3·5
Width centrum	1·5

This species was discovered by Prof. Jno. S. Newberry, at Linton, Eastern Ohio, in the slate of the coal measures. Mus. Columbia College.

The characters of the genus are further shown by a part of another individual in the same coal slate matrix. The cranium and anterior portion of the vertebral column only are preserved, the latter so much injured as to render the vertebral characters very obscure. As in the other, the bristle-like scales extend along the dorsal region to near the cranium. The anterior two-fifths of the ventral side shows a large number of small oval scale-like bodies, which belonged undoubtedly to the animal and were probably dermal scales. They are, however, neither regular in form or position. Close behind the head two or three long bones of the fore limbs have been exposed. They are slender, and similar to those of the last specimen.

The cranium, though without the muzzle, shows its long wedge-shape. The maxillary bone cannot be distinguished, nor can the orbits be made out; one ramus mandibuli is pretty well preserved; it shows no coronoid process. Twenty-one teeth may be counted on a portion a little more than one-third its length. The anterior eleven of these are abruptly longer and stouter than the others. They are, except a few most anterior, in pairs, *i. e.* with a slight vacancy between every two. The larger ones were broken at the bases, exhibit a moderate pulp cavity; the smaller, a large one extending to near the tip. Several, though not all of the larger teeth, display a shallow groove on the external face to near the tip, which is probably owing to pressure, and a partial crushing. The points of the larger teeth are rather abruptly acute, and turned abruptly backwards. A portion of their increased length (·25) is to be attributed to the splitting off of the external dentary margin, and the exposure of the roots. No alveoli are shown, and the dentition is probably pleurodont, with anchylosis of expanded base as in true Labyrinthodonts.

MOLGOPHIS Cope.

This genus is established on remains represented by three specimens, which are two series of dorsal vertebræ with ribs, and a series of caudals. One of the dorsal series embraces sixteen vertebræ, the other fourteen; the caudal series, twenty-two.

From its serpentine form this genus may be compared with the Dolichosoma of Huxley, though a close relation does not exist between them. In the Irish genus the series of caudal vertebræ is quite short, and the ribs are short and but little curved. In Molgophis the tail has been like that of an elongate serpent, and the ribs are as well developed as those of many reptiles.

Though no limbs or arches can be certainly found, a rather quadrate, parallelogrammic piece, about as long as the diameter of a vertebra, may be a femur. This is, however, very doubtful.

The characters of the genus are, a long serpentine body, without dermal armature, so far as discoverable; the vertebræ large and broad, with very prominent zygapophyses and moderate neural spine, those of the caudals without narrowed bases (and grooved or serrate edges, most probably). ? Limbs and cranium unknown.

This genus differs from Urocordylus in its caudal vertebræ, and from Ophiderpeton in its dorsals; the latter, in their zygapophyses projecting laterally, resemble those of Amphiuma. It differs from Sauropleura in the absence of ventral dermal bands and in the longer body, without indication of limbs. The size of the vertebræ would indicate a body of the size of a rattlesnake, (C. horrida), and therefore too large for the species named Brachydectes newberryi.

The ribs are long, and though the head is not bifurcate, there appear to be both tubercle and head on the dilated extremity. They show themselves, where crushed, to have had a large median vacuity.

Molgophis macrurus Cope.

The neural arches, viewed from above, have a posterior V-shaped outline, from the fact that the broad zygapophyses meet on the median line, and spread out distally over the broad anterior ones adjoining. The latter appear to be somewhat concave, and to border the former exteriorly as well as inferiorly. The base of the neural spine extends to the posterior emargination, but not quite to the anterior. The breadth of the dorsal vertebra above is equal from the emargination behind to the anterior margin of the anterior zygapophyses.

The caudal series must have been very long, as there is very little diminution in the size of the vertebræ throughout the series preserved. They present much the same form as the dorsals, but are more contracted medially, and the zygapophyses have a more transverse direction. There may indeed be a diapophysial element beneath these, but the two cannot be distinguished if so. They are connected by longitudinal impressions indicating the existence of the tendinous bands in the longitudinal muscles seen in Amphiuma, or the osseous spicules in the same situation in birds. The neural spines, indicated by their narrow bases, occupied the lengths of the neural arch, and remind one of Amphiuma.

The ribs are long for a Batrachian, but shorter than in a reptile. They are well curved, chiefly near the proximal extremity. The longest I can find, measured by a chord, equals two vertebræ and two-fifths. Three vertebræ measured along the median line above equal eleven lines; one of these is 3·6 lines in width above; width of a (?) posterior caudal 3 l.

This animal has been, like Amphiuma, a snake-like Batrachian, but probably of even more elongate form. How near its affinities to this genus may be, cannot be ascertained, owing to want of important parts of the skeleton, but it differs in the important feature of the large, well developed ribs.

LABYRINTHODONTIA.

DITCYOCEPHALUS Leidy.

Dictyocephalus elegans Leidy, Proc. Acad. Nat. Sci., 1856, 256. Emmons Geology North Amer., p. 59. Tab. 31.

Triassic Coal Measures, Chatham Co., N. Carolina.

CENTEMODON Lea.

Centemodon sulcatus Lea, Proc. Acad. Nat. Sci., Phila., 1856, 78.

Triassic Shales near Phœnixville, Chester Co., Penn.

BAPHETES Owen.

Baphetes planiceps Owen, Quart. Journ. Geol. Soc. Lond. x, 1853, (xi, notes).

Carboniferous Coal Measures of the Joggins, Nova Scotia.

EUPELOR Cope.

Gen. nov. *Char.* Teeth subcylindric, with large pulp cavity at the basis only; external surface without grooves; dentine divided by numerous flat vertical laminæ of a dense substance, probably enamel, which radiate from very near the pulp cavity to the external enamel layer.

The species on which this genus depends was originally described by the writer as a Mastodonsaurus. The latter genus, however, exhibits external grooves where the inflections of enamel enter and separate the dentine. These inflections, as is well known from the figures and descriptions of Professor Owen, are more or less convoluted, some of them very highly so. The laminæ of the teeth of the Eupelor cannot be looked upon as inflections of enamel, but rather as branches. They are exceedingly thin, and our sections do not demonstrate them to be double. If they are double they are very much more attenuated than the external enamel stratum. They may be distinguished in a section of the wall of the pulp cavity at the base of the root as well as elsewhere.

Eupelor durus Cope, *Mastodonsaurus durus* Cope. Proceed. Acad. Nat. Sci., Phila., 1866, 249.

From the Triassic Red Sand Stone near Phœnixville, Chester Co., Penn.

On AGAPHELUS, a genus of toothless Cetacea.

BY EDW. D. COPE.

During the autumn of 1866 a whale was cast ashore on the Long Beach, Ocean Co., N. J., opposite Westecunk, on the other side of Little Egg Harbor, near the residence of Wm. A. Crane. A recent visit to the spot furnished me with the means of determining the species to which this monster of the deep belonged, although not with the completeness desirable, as the tide had a short time previously taken off the most bulky part of the carcass. Thus the cranium, cervical and dorsal vertebræ, with the first ribs, the most important portions for its identification, were lost. There were preserved, however, the mandibular arch, ear-bone, one scapula and both fins, numerous ribs, many lumbar and caudal vertebræ, with the baleen from one side of the maxilla. These portions, with a few prominent points dependent on the observations of Wm. A. Crane, serve to indicate a species not only new to our fauna, but new to modern science. The evidence of my informant, as that of an old and experienced coaster and waterman, and one familiar with the appearance of our cetaceans, confirmed by his sons and by the specimens preserved, so far as they went, I consider reliable. That the species should have remained undescribed until the present time will not appear surprising to those who read carefully Gray's recently issued "Catalogue of Cetaceans," or Eschricht and Reinhardt "Om Nordhvalen," Copenhagen, 1861.

The scapula preserved is low and elongate, with well-developed acromion and coracoid process. It is evidently of the type of Balænoptera and Physalus; the ulna and radius relatively less elongate than in Sibbaldius laticeps and borealis, being 1·5 as long as the humerus, thus resembling Physalus. The four fingers, with the second much the longest, form a fin of the type of these genera. The ear-bone is much more compressed than in Physalus antiquorum or Sibbaldius laticeps. The mandibular ramus is rather massive, moderately curved, and with a more elevated coronoid process than in any whale that I have seen. The greatest peculiarity is in the form of the lumbar and anterior caudal vertebræ; they are of a much more elongate form than any I have seen or found figured, excepting those of the Balænoptera rostrata (as figured by Gaimard in Voyage de la Recherche), which, however, are relatively shorter. Those of the present species are of greater length than transverse diameter, the lumbars most elongate; all furnished with an acute hypapophysial keel and concave sides, and entirely transverse diapophyses. This peculiarity is consistent with the account of my informant, who stated the animal to have been of an unusually elongate and slender form. When it came ashore it had perhaps been dead ten days; the flukes and muscular region as far as the third caudal vertebra had been devoured, probably by sharks and killers, and the abdominal region much lacerated; the edge of a fin preserved was slit by the teeth of some carnivorous enemy. The measurement from the end of the muzzle to the end of the third caudal was 35 feet, which may be reduced to 33 feet axial. Up to this point the dorsal line was, according to my informant, entirely smooth, without knob or fin, or scar of one; hence I suppose the fin (if present) to have been situated as in Sibbaldius, &c., at the posterior fourth of the length, and not as in Balænoptera, on the posterior third. It may then be safely assumed, bearing in mind the form of the vertebræ, that ten feet of the whale's length had been removed, making in all 43 feet. That the species attains over 50 feet is probable, as the present individual was quite young, the epiphyses separating from the vertebræ with the greatest ease. The slender form of the animal is corroborated by the slenderness and slight curvature of the ribs, one attached beneath the scapula, probably the second, being narrower than the corresponding ones in Sibbaldius. I therefore think it most probable that in this form the anterior ribs are single-headed.

The baleen is peculiar; throughout the length of the maxillary bone it nowhere exceeded one foot in length, and the width of the band, or length of the base of each plate, four inches. It is of a creamy-white; the fringe very coarse, white, and resembling hogs' bristles.

The proportions in most respects present a contrast to those of Physalus species, and Sibbaldius species. While the cranium and fin of the Physalus antiquorum are of about equal length, the latter is four-sevenths the former in the present species. In the Physalus the cranium enters the length 4·7 times; in Sibbaldius laticeps 4·06, and in the present species 6·6 times; in Balænoptera rostrata 4·5 times.

In general features this Cetacean seems to be an intermediate form of the toothless whales; and an additional feature, which depends on the observation of my friend W. Crane, and in which I cannot conceive it possible that he should be mistaken, indicates still more conclusively that it pertains to a genus not before characterized. The whale was first driven on shore on its back, and the gular and thoracic regions were seen to be entirely without ridges or plicæ of any kind, but as smooth as any other part of the body, or as the throat of a right whale, Balæna *cisarctica* Cope, which is not uncommon on the same coast.

This my informant told me was the species known among the whalers as the "Scrag Whale." Though this name is indefinite when applied by whalers of different nationalities, it is probably used with accuracy by those accustomed to any particular region. At any rate I have little doubt that this is the species called by the same name by Dudley, who in 1725 wrote an account of the whales known by the whalers of the coasts of New England. He says it is near the right whale (B. *cisarctica*) in figure also; "is near akin to the fin-back, but instead of a fin upon its back, the ridge of the after part of its back is scragged with half a dozen knobs or knuckles. He is nearest the right whale in figure and quantity of oil. His bone is white, but won't split." This is published, with an account of the other species known, in the 33d volume of the Philosophical Transactions. He mentions particularly the fin-back and hump-back whales, describing the deep folds of the chin, throat and sides of those genera. There can be little doubt that his "scrag whale" had a smooth throat like the Balænæ, and not a plaited one like the Balænopteras and their allies. By the preceding account it has been shown that the species has but four slender fingers at the carpus; hence it is obviously the type of genus intermediate between Balæna and Megaptera, not hitherto recognized,—furnished, however, with the scapula of Balænoptera.

Captain Atwood, a resident of a part of the peninsula of Cape Cod, Mass., who is a good observer of the life of the ocean, thus writes of the scrag whale in J. A. Allen's Catalogue of the Mammals of Massachusetts, in the Proc. Boston N. H. Soc. for 1868:

"Scragg.—A species of whale known by this name, and nearly allied, if not identical with the right whale, is sometimes taken here. It is the opinion of many of our whalemen that they are not a distinct species, but are the young right whale that lost its mother while very young, and has grown up without parental care, which has caused a slight modification. The most prominent feature is on its dorsal ridge; near the tail there are a number of small projections or bunches, having some resemblance to the teeth of a saw. It has no dorsal fin or hump on its back."

Additional evidence of the existence of this genus has been furnished by the Smithsonian Institution. In accordance with recommendations and directions furnished by the writer, Wm. H. Dall, the enterprising director of the West Coast Scientific Exploring Expedition, originally commanded by Dr. Kennicott, sent to the Institution drawings and descriptive notes of the grey whale of the coasts of Upper and Lower California. The writer has also examined an almost complete set of whalebone, with some other portions of the same species, in the museum of the Essex Institute, at Salem, Mass. The baleen is similar in character to that of the present species, but presents specific differences. The notes of Capt. Dall indicate a long-finned, smooth-throated whale, with a flat-pointed head like a fin-back, and no dorsal fin, but a series of knobs on the posterior region of the back. That it in all respects conforms to the generic type of the Atlantic species, can be determined from the description which follows.

The Atlantic species was named from Dudley's description by the compiler, Erxleben, without his adding to our knowledge of it, Balæna *gibbosa*. I will follow Dr. Gray in adopting this name. The latter author, in his excellent Catalogue of Seals and Whales in Brit. Mus., refers it, on the basis of the same description, to Balæna, with doubt.

Genus AGAPHELUS Cope.

Fingers four, elongate. Cervical vertebræ? Lumbar and anterior caudal vertebræ longer than their greatest diameter. Dorsal fin wanting. Gular and pectoral region without folds. Scapula with well developed acromion and coracoid. Baleen narrow, short.

AGAPHELUS GIBBOSUS Cope.

Scrag Whale, Dudley, Philos. Trans. xxxiii., 250, and of The Whalers.

Balæna gibbosa Erxleben, Systema Mammalium 610 (from Dudley), and after him of Gmelin, Bonnatere, Lacepéde, Virey, Gerard, Desmarest & Fischer. Gray, Catal. Brit. Mus. 1850, p. 18, and 1866, p. 90.

Agaphelus gibbosus Cope, Proc. Ac. N. Sci. Phila., 1868, 159.

Balænoptera rostrata Cope, Proc. Ac. Nat. Sci., Phila., 1867, 147.

	Ft.	In.
Total length (estimated) of young	43	
Length to third caudal vertebra	33	
Length of cranium (estimated)	6	10
" mandibular ramus (in curve)	6	
" pectoral limb	4	
Width of " "		15
Length of humerus		11·5
" radius and ulna		17
Posterior margin of scapula		14
Length of coracoid from glenoid cavity		3·3
" glenoid cavity		6·3
Mandible, length from condyle to coronoid		13·5
" depth at coronoid		8·5
" " 2·5 feet from coronoid		4·6

The form of the mandibular ramus is pecnliar, and more like that of the Balænoptera rostrata than any other. It is triangular in section, having an inferior angulated ridge, and a broad, slightly convex, superior face, instead of their usual ridge. Such a ridge leaves the coronoid process, but soon turns inwards to form the inner outline. Width of the superior face 3·5 inches. The coronoid process is quite elevated, and turned outwards. In the fresh animal the lower lip included the upper all round. The laminæ of whalebone are placed on a base having a sigmoid flexure. Greatest depth of the gum 1 in. 3 lines. Within each principal lamina are two supplementary laminæ, the intermediate being the narrower, the inner triangular, its intermediate bristles arising from the gum. The bristles of the supplementary plates are longer and finer than those of the outer; in the latter, three series of bristles are enclosed between very thin enamel plates. All the laminæ are thin, five in an inch, and split transversely straight; white cream-colored, with a purplish shade near the centre of the base. The ulna is slender, but furnished with a prominent rounded and flattened olecranon, which is prolonged into a thin cartilaginous plate, formed like the diapophysis of a vertebra, and in the plane of the ulna; this structure appears to have been ossified in the Sibbaldius borealis Fisch., as figured by Dubar In the Agaphelus gibbosus it occasions an abrupt angulation near the basal third of the inner margin of the fin. In the scapula, the coracoid is in its plane, but the larger acromion diverges outwards.

The anterior caudal vertebræ are more elongate than the lumbosacral, less depressed, and with the centra in every way larger. All are sharply keeled on the median line below, with a concave face between the keel and the base of the diapophysis. The caudal and lumbosacral diapophyses are obspatulate, the anterior becoming narrower. The neural spines of the lumbar vertebræ are much elevated, concave above both before and behind, the zygapophysis measuring a point considerably below the middle.

		In.
Third (?) caudal (not perforate)	length centrum	7·3
	depth	6
	width	6·5

	height neural spine	9·5
	zygapophysis	4·3
	length diapophysis (from front base)	3 3
Lumbosacral 1;	length centrum	7·3
	depth	5·3
	width	6·3
	height neural canal	2·5
	width	1·5
	height neural spine	15·3
	zygapophyses	5·5
	length diapophysis	7·5
	greatest width do.	5·3
Lumbosacral 2	(more anterior) length centrum	6·3
Lumbosacral 3	(anterior) height centrum	4·3
	width "	6
	length diapophysis	7·7

The ear bone is much compressed, with an inferior carina, towards which the lip of dense bone is suddenly decurved. The longitudinal opening is much contracted, especially anteriorly, where the bone is pinched up into a keel, and there is no abrupt concavity of the inner lip at that point. External surface not very rugose. Total length 3 in 2·5 lines.

The owner of the whale tried out about one-fourth of the blubber, and procured sixty-five gallons of oil, which would give about four hundred gallons for the whole; the thickness of the adipose layer would not average 4 inches, the greatest thickness was 5 inches.

This species was black above and white below, the sides lead-colored, with longitudinal shades of the darker color; fins, basal half white, terminal black.

AGAPHELUS GLAUCUS Cope, sp. nov.

The points in which this species differs from those of the genus Balæna, previously known, are numerous, and will no doubt be increased on a further knowledge of the animal. The head, between one-fourth and one-fifth of the total length, allies it to the shorter headed species. From the B. australis, the number of dorsal vertebræ, and the color and shortness of the baleen, distinguish it, and no doubt other features will be brought out when we are acquainted with the Cape species. The dorsal serration is not known to occur in any species of the genus Balæna, though said to be characteristic of the A. gibbosus, whose characters I have just given. Two Balænæ have been described as inhabiting the north Pacific Ocean, Balæna sieboldii Gray,* and Balæna cullamach Chamisso.† Both have been established on figures carved by the natives of the Japanese and Aleutian Islands respectively, the former under the supervision of a naturalist, the traveller Siebold. The carving of the B. cullamach, judging from the figure given by Chamisso, can but doubtfully represent any species, but which, if it exist, will rest on the following diagnosis of its describer: "Rictu amplo forma litteræ S curvato, elasmiis maximis atrocorruleis, spiraculis flexuosis in medio capite, tuberculo in apice rostri (ex imagine) pectore pinnisque pectoralibus albis dorso gibboso sexpinnato."

These are, however, true Balænæ. A species of Agaphelus exists in the Kamtschatkan Seas, according to Pallas, who, however, derives his information solely from wooden models made by Aleutian Islanders. This is not sufficient basis for an introduction to the scientific system, yet Pallas indulges in applying to it the name *Balæna agamachschik*. The pectoral limb of this species is said, however, to be white, with the under side of the flukes, charac-

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* Catalogue Cetaceans, 1865, 96, Fauna Japonica, Temminck & Schlegel, t. 28, 29.
† Nova Acta Acad. Caes. xii., p. 251, Tab.

ters not found in the A. glaucus Dr. Gray has already (Catal. Brit. Mus.) indicated that this, if reliable, indicates a genus unknown to him.

The Agaphelus glaucus is the gray whale of the coasts of California. Two specimens have been examined by my friend, Wm. H. Dall, of the Scientific staff of the U. S. Russian American Telegraph Expedition, one of them near Monterey, and descriptions as complete as the state of the specimens would allow, were made. These, which were sent to the Smithsonian Institution, and placed in my hands by Prof. Baird, are quite sufficient to indicate a whale of a species hitherto unnoticed, and to render certain its future identification.

Specimen No. 1, a skeleton nearly complete.

	Ft.
Length of cranium	10
Of dorsal vertebræ	12
Lumbar and caudal (except of the fluke)	26
? Vertebræ of fluke	? 3
Total	51

Dorsal vertebræ and ribs, thirteen; lumbar and caudal (those in the fluke cut off with it), 28. Scapula, breadth and height not very different, with a short, broad coracoid process; its head opposite first rib. Apparently only four fingers, of which the second is the longest. 145 laminæ of baleen on each side, the longest eighteen inches long; color light yellow.

Specimen No. 2, killed by the "killers," (orca); skeleton still concealed by mass of muscle, etc.

External measurements.

	Ft.
Flukes to anus	14½
Anus to sulcus penis	2
Length of sulcus	1½
Latter to plane of flippers	15
Plane of flippers to end of mandible	15
Total	48

The lower jaw is four inches longer than the upper; the blow-holes are entirely concealed by four dermal plicæ, which accounts for the small misty spout peculiar to the species.

	Ft.	In,
Length of flipper and shoulder	6	
" mouth	10	
" exterior canthus of mouth	1	6
" from chin to eye	10	4
" from eye to margin of canthus		6
Width of caudal flukes	8	9
Width of mouth at canthus	4	
From chin to blow-holes	4	9
Longest baleen		14

Head of humerus opposite third rib; anterior angle of scapula just anterior to first rib. On the vertebral line, for fourteen feet from the caudal flukes, is a series of 18 ridges, like the teeth of a saw, which are altogether dermal in their character. Blubber 4—8 inches thick, thickest near the jaws and on the back near the tail; yield of oil 35 bbls. Epidermis 1 inch thick, carium ·75, with numerous pores. Blow-holes 2—4 inches apart. On each side of sulcus penis a mammary sulcus a few inches shorter.

Color above and below, black, with a gray bloom like a plum. This distinguishes this species from the known Balænæ of the Pacific, which are more or less white on the belly and fin.

Specimen No. 3. A full set of baleen of one side the maxillary is in the Mus. Essex Institute, Salem, Mass. A portion of this, kindly lent me, exhibits the following characters: Compared with that of the A. gibbosus, it is longer and has narrower basis. The plates moderately and simply concave, while those of the latter are sigmoidal, most curved near the outer margin, in cross section. The bristles of the California species are very coarse, varying from one to three series between the enamel plates. The bristles of the A. gibbosus much finer, three series together. Length of the latter 8·5 inches, width at base 4·4 inches. In the Agaphelus glaucus Cope, 22 in. in length, width at base 6 in. In the former nearly 6 in an inch, in the latter 2½. The baleen of the A. gibbosus belonged to the specimen above described.

Two rough outlines accompany Capt. Dall s notes. Both represent the pectoral fin as rather elongate, not pointed, but rather broad at the extremity. A third sketch represents the inferior view, and in it we see two lines for grooves, one on each side the median gular line. This feature, if existing, is interesting, as indicating a tendency to the plicæ of the fin back whales.

This species has usually one calf at a birth, but one was recently taken at San Diego with two fœtuses. Penis 27 in. long, smooth, coarsely papillose, slightly bifid at tip, where the urethra is about the size of a goose quill. (Dall's m. s.)

Oct. 6th.

The President, Dr. Hays, in the Chair.

Thirty-five members present.

The following paper was presented for publication:

Notice of some American Leeches. By Joseph Leidy, M. D.

Oct. 13th.

Mr. Cassin, Vice-President, in the Chair.

Thirty-four members present.

The following papers were presented for publication:

Notice of some Remains of Extinct Vertebrata. By Joseph Leidy, M. D.

On the Origin of Genera. By Edward D. Cope.

On some Cretaceous Reptilia. By Edward D. Cope.

On variations in Taxodium. By Thomas Meehan.

Oct. 20th.

The President, Dr. Hays, in the Chair.

Thirty-six members present.

Dr. F. A. Genth made some observations on the occurrence of cupriferous ores in Texas.

Dr. A. R. Roessler, Geologist at the U. S. General Land Office at Washington, had sent him for examination a specimen from Weatherford, Archer Co., Texas. It was a piece of copperglance, containing 55·44 per cent. of copper, pseudomorphous after wood or a vegetable substance. It resembled so much similar pseudomorphs found in the Permian formation at Frankenberg in Hesse, and elsewhere in Europe, that he pointed out the probability of its occurring also in the Permian formation, and requested Dr. Roessler to obtain fuller details with reference to its occurrence. A few days ago Dr. Roessler received an answer to his inquiries from the General Land Office agent in Texas, with more specimens. and the following report, which he sent to me:

"After traversing the cretaceous and carboniferous series northward of Weatherford, Archer Co., Texas, I was agreeably surprised by a grand panorama of the Permian formation. This system is extensively developed in Russia between the Oural Mountains and the River Volga, in the north of England, and in Germany, where it is mined for its treasures of copper, silver, nickel and cobalt ores. It has not heretofore been known to exist in this State, or it had been mistaken for the Triassic system, which is overlying the former to the south-east. Its hills, which have been traced throughout Archer and Wichita Counties, resemble in shape the copper-bearing or gossan-crested upheavals in Ducktown, Tenn., but they are of a different age and composition. They are nearly barren, and, towering above the most beautiful mesquit prairies fringed by the finely-timbered bottoms of the tributaries of Red River, are exceedingly picturesque. The members of the Wichita System, as far as open to ocular inspection by out-crops or cross-cuts, making allowance for climatic differences, correspond closely with the lower strata, discovered at Perm and Mansfeld, but its mineral resources are evidently more promising. Such numerous veins of copper ore have been traced over the summits and sides of the hills, that hardly a hundred and sixty acre tract could be found without ore on the surface. The ore crops out, as, for instance, on the Isbell Douglass Ball, in such quantity and quality that the mere collection of it, without mining, would prove remunerative. It is supposed that those veins are cotemporaneous with injections at different ages of quartz, trap and porphyry. The vein lodes are parallel with the strata, but there is sufficient evidence that they partake of the nature of true veins. Cupriferous and ferruginous cross-courses, feeders and leads of manganese are often met with. A cross-cut was made to a depth of about fifteen feet upon the Isbell lode, and ten hours work resulted in the raising of 6000 pounds of copper ore. This ore is far superior to the ferro-sulphuret of copper, or copper pyrites, which ore is most generally worked in England, and it is, in fact. more profitable than the native copper as found at Lake Superior. It is easily smelted, and the strata in which it is found can also be more economically excavated than any other in which copper ores occur."

Dr. Le Conte, in continuation, spoke of the occurrence of calamite tinged with copper in the Permian formation of Southern Mexico.

Mr. Gabb mentioned the deposits of grey copper near the Colorado River, in Arizona, scattered over the surface, the debris of metallic veins.

Dr. Leidy remarked, that shad had been brought to our markets, for several years past, during the late autumnal months, which were caught in salt water, perhaps in Delaware Bay or off the Jersey coast. When the shad ascend the river to spawn, their stomachs and intestines appear to contain so little that the question is often asked as to the nature of their food. A shad which Dr. L. had purchased a few days since, on examination, was found to have the stomach full of small fishes. There were 30 of them. from 2 to 4 inches long, and all one species, which appears to be the Sand-launce, *Ammodytes Americanus*.

Oct. 27th.

Mr. Vaux, Vice-President, in the Chair.

Twenty-six members present.

Philip S. Wales, M. D., was elected a member.

The following gentlemen were elected correspondents: L. E. Latemer, M. D., of New York; A. A. Breneman, of Lancaster; H. Evan Rijgersma, of St. Martin's, W. I.; Prof. Oliver W. Holmes, of Boston.

On favorable report of the Committees, the following papers were ordered to be published:

Notice of some American LEECHES.

BY JOSEPH LEIDY, M. D.

Having been invited by Mr. R. H. Lamborn, Secretary and Treasurer of the Mississippi and Lake Superior Railroad Company, to join an excursion to Minnesota and Lake Superior, the last summer, during the trip I had the opportunity of making many interesting observations in natural history. The many lakes of Minnesota are rich in mollusca, annelides, &c. Among the annelides, besides an abundance of the ordinary American medicinal leech *Hirudo decora*, I noticed one which struck me from its general resemblance to a variety of the European medicinal leech, *H. medicinalis*. One of the gentlemen in company with us, Mr. Clark, allowed me to try upon him its disposition to bite, but I did not succeeed in getting the animal to do so. Upon examination of the leech, I find it belongs to a different genus from *Hirudo*, apparently to the genus *Aulastomum*. Its characters are as follows:

AULASTOMUM LACUSTRIS, n. s.

Body cylindroid, compressed, narrowing anteriorly, obtuse at the sides (in movement more cylindroid, or less flattened, and quite obtuse laterally compared with *Hirudo decora* in the same condition). Color throughout olive green, (with more of a yellowish hue than in the dorsal green of *H. decora*), closely maculated everywhere with confluent spots of a darker hue of the same color. Ninety-two annuli, exclusive of the lips, of uniform width, smooth. Upper lip half ovate, obtuse; lower lip narrow. Eyes ten; eight in the upper lip; the last pair separated by an annulus from the others. Mouth obliquely terminal, large. Acetabulum subbasilar, ventral, sessile, circular. Anus dorsal, above the acetabulum. Male aperture in the 24th annulus (but apparently between the 23d and 24th). Female aperture in the 29th annulus (apparently between 28th and 29th). Oesophagus capacious, extending to about the 22d annulus, with 12 folds. Jaws three, small, when at rest included in pouches formed by an eversion of the mucus membrane. Teeth 12 in number to each jaw, bilobed at base. Length 4 to 5 inches, breadth 5 lines posteriorly; acetabulum 2 lines in diameter.

Var. An individual of lighter olive green than the former had black maculæ replacing the dark green ones, which were also more distinct and fewer.

Specimens described from Twin Lake, Minnesota. In the summer of 1865 I saw several leeches at Saut St. Marie, in Lake Superior, which so far as I can remember were of the same species. At the edge of the shore I also saw some cocoons which I supposed to belong to the same animal. They were ochreous yellow, oval, about 4 or 5 lines in diameter; the surface impressed with concave pentagonal and hexagonal pits. From the angles of the margins of the latter projected branching processes curling at the ends.

Notwithstanding our familiarity with the American medicinal leech, its long and frequent employment in the medical profession, and the vast numbers which have been brought to notice, it has been so imperfectly described that, in the excellent Systema Helminthum of my late esteemed friend Dr. Diesing, of Vienna, it has been placed with the "Bdellidea species genere penitus dubiæ." I therefore take the present opportunity of indicating its characters more fully. It agrees most nearly with the diagnosis of the genus *Hirudo*, of which the *H. medicinalis* of Europe is the type, but nevertheless possesses peculiarities perhaps rather more than specific. Its characters, generic and specific, are as follows:

Hirudo decora.

Say: Long's Expedit. vol. ii, 1842, Append. 268. Moquin-Tandon: Monog. Hirud. 1846, 344. Diesing: Syst. Helm. i, 1850, 474. Wood and Bache: United States Dispensatory.

Body elongated, compressed cylindroid, narrowing anteriorly, laterally subacute; in motion convex above, flat below, with the margins compressed, thin, acute and somewhat wavy; composed of from 90 to 94 annuli, which are uniform and smooth. Head continuous with the body. Mouth obliquely terminal, bilabiate; the upper lip prominent, semiovate, obtuse, or from contraction of the tip emarginate; lower lip forming the inferior portion of the first annulus; the lips together acting as an acetabulum ovoid or obcordate in form. Eyes 10, arranged in horse shoe form, the anterior 8 above the upper lip, the posterior pair separated from the others by the first annulus. Acetabulum subbasilar, ventral, sessile, circular. Anus dorsal, above the acetabulum. Male aperture perforating the 25th annulus, with the lips more or less prominent. Female aperture between the 29th and 30th annuli. A group of four papillæ situated back of the latter on the 34th to the 36th annuli inclusive. Jaws three, semicircular, laterally compressed, furnished with 55 teeth, which have an acute curved summit and an expanded bilobed base. Oesophagus short and narrow compared with that of *Aulastomum*, furnished with 6 longitudinal folds, of which three coarse ones descend from the jaws and three narrow ones are intermediate.

Color. Dorsal surface olive green, with a median irregular band and a lateral line of darker hue of the same kind; a median row of reddish brown dots, and a lateral row of black dots. Ventral surface reddish brown, extending slightly above the lateral margin, devoid of spots, or more or less maculated with black. Acetabulum colored like the back above and the belly below.

In the genus *Hirudo*, as characterized by Diesing, (Syst. Helm. i, 465), and to which he assigns 9 recognized species, the jaws are furnished with from 60 to 70 teeth, and the male aperture is situated between the 24th and 25th segments. Moquin Tandon (Monog. Hirud. 1846, 326) likewise assigns the latter as the position of the male aperture in the genus *Hirudo*.

The position of the generative apertures in *H. decora* often appear more or less discolored, or of a dull purplish hue, and the same is the case with the group of papillæ back of them. The latter do not exist in the medicinal leech of Europe. They are quite conspicuous in ours. I have suspected that they were provided for the adherence of individuals in sexual intercourse, and this view is confirmed by Mr. S. J. Moore, the well known professional leecher and bleeder of this city. Mr. Moore informs me that in copulo two individuals adhere in the position of the papillæ and make two turns of a spiral upon each other.

The red and blacks spots of the back contain from 20 to 22 in each row.

Length up to 7 inches, by 8 lines in breadth posteriorly; and the acetabulum 3 lines in diameter.

Notice of some remains of Extinct PACHYDERMS.

BY JOSEPH LEIDY, M. D.

Dicotyles nasutus.

Extinct Peccary. Leidy: Pr. A. N. S. 1860, 416.

An extinct species of Peccary, obviously different from any one heretofore noticed, is indicated by a specimen submitted to my examination by the late Dr. David D. Owen. It was found in digging a well in Gibson Co., Indiana, at a depth of between 30 and 40 feet.

The specimen consists of the fore part of the snout, containing on one side of the jaw the upper canine and anterior two molar teeth. It belonged to a species larger than any of those previously noticed. The face in advance of the molars was more prolonged proportionately than in other species, but was also proportionately narrower.

The two premolars retained in the fossil are blunted from wear, but are clearly constructed after the same pattern as those of the living Peccaries.

The incisors, as indicated by their alveoli, held the same relative position as in the latter, but appear to have been comparatively feeble organs, and the anterior pair were but slightly larger than the lateral ones.

The upper canine has the same form and mode of insertion as in the recent Peccaries, but is proportionately smaller.

The anterior ends of the coössified premaxillaries project to a much greater degree in advance of the incisors than in the other known Peccaries. They are also more truncate in appearance; and on each side of the intermaxillary notch they exhibit a conspicuous pit, apparently for the attachment of a pair of muscles intended for a longer and more mobile snout than is possessed by the living Peccaries.

The measurements of the fossil compared with those of other Peccaries, are as follows:

	D. nasutus.	compressus.	labiatus.	torquatus.
First molar to front of premaxillaries,	58 lines.	46 lines.	41 lines.	31 lines.
" " to canine alveolus,	30 "	23 "	14 "	8 "
Length of jaw in advance of canines,	24 "	19 "	20 "	17 "
Breadth outside of canine alveoli,	28 "	29 "	31 "	26 "
Ant. post. diam. first premolar,	$4\frac{1}{2}$ "	$4\frac{3}{4}$ "	5 "	$4\frac{1}{4}$ "
" " " second "	$5\frac{1}{2}$ "	5 "	5 "	$4\frac{1}{2}$ "
" " " base of canine,	$5\frac{3}{4}$ "	$6\frac{1}{2}$ "	8 "	6 "

Mr. Timothy Conrad has recently submitted to my inspection the crown of a second molar tooth obtained by Dr. P. Knieskern, from a miocene formation of Shark River, Monmouth Co., New Jersey.

The tooth bears nearly the proper relation of size with the premolars in the specimen above described of *D. nasutus* to belong to the same animal, but the fact of its being found in a miocene deposit, while the latter is of supposed post-pliocene age, renders it probable that it pertains to a different species.

The crown has a strong basal ridge, hardly interrupted at the most prominent portion of the lobes externally and internally. The lobes present the same form and relative position as in *D. labiatus*. They are considerably worn, exhibiting on their summits exposed tracts of dentine; nearly circular on there external, and larger and irregularly reniform on there internal. The measurements of the tooth in comparison with the corresponding tooth of other species are as follows:

Fossil tooth,	ant. post. diam.	$9\frac{1}{4}$ lines,	trans.	$8\frac{1}{4}$ lines.
D. labiatus,	" "	7 "	"	$6\frac{3}{4}$ "
D. torquatus,	" "	$6\frac{1}{2}$ "	"	$5\frac{1}{2}$ "
D. compressus,	" "	$7\frac{3}{4}$ "	"	$6\frac{3}{4}$ "

ANCHIPPUS TEXANUS.

An apparent solipedal pachyderm, allied to *Anchitherium*, is indicated by a specimen consisting of the greater and more characteristic portion of an upper molar tooth submitted to my examination by Dr. B. F. Shumard. It was obtained from "Hutchen's well," from a yellow sandstone, supposed to be of miocene age, at a depth of 50 feet below the surface, in Washington Co., Texas.

The size of the tooth, as well as the general form and proportions, have been nearly as in the European *Anchitherium aurelianense*. Six lobes, as in the latter, enter into the constitution of the crown. The external lobes, imperfect, appear to have had the same form as in *Anchitherium*. The inner lobes also have the same form but are proportionately less robust, while the median lobes are more so. The postero-median lobe pursues the same course as in *Anchitherium* and likewise, as in this, joins the outer lobes at their conjunction. From near the middle of its course it gives off a process directed towards the interval of the antero-internal and antero-median lobes and ceasing short of them. This process looks as if disposed to join the contiguous portion of the antero-median lobe, together with it to form a crescentoid lobe, embracing the antero-external one, as in the corresponding columns of equine teeth. No such arrangement exists in *Anchitherium*. A triangular tubercle, as in the latter genus, occupies the space at the back of the crown, and it appears as if its anterior angle had a disposition to join the contiguous portion of the postero-median lobe, to form with it a crescentoid lobe, in like manner as in the former case, to embrace the postero-external lobe.

The construction of the tooth clearly indicates an animal of intermediate character to *Anchitherium* and *Equus*.

ANCHIPPODUS RIPARIUS.

Mr. Timothy Conrad has submitted to my examination the specimen of a tooth of rather enigmatical character, which I suspect to indicate a *pachyderm* at least with solipedal affinities. It was obtained by Dr. Knieskern, from a tertiary formation, either eocene or miocene, of Shark River, Monmouth Co., New Jersey.

The tooth would appear to correspond with a first or second lower true molar of a ruminant, or with any of the series between the first and last molars in *Palæotherium* or *Anchitherium*. The crown is much worn, even so as to obliterate some of its distinctive features. It is composed of a pair of demi-conoidal lobes, one before the other, the plane side internally, the convex and sloping side externally. From each lobe descends a fang in the usual manner. No fold, and only a feeble basal tubercle occupies the deep external angular interval between the lobes. The worn triturating surface presents, on the anterior lobe, a wide crescentoid tract of exposed dentine, slightly concave and bordered with thick enamel. The anterior arm of the crescent is obtuse; the posterior extends less inwardly and is acute. The posterior lobe exhibits a half ellipspoidal tract of dentine, nearly straight at its inner margin, and bordered with enamel, except behind, where it has all disappeared. The dentinal tracts of the two lobes are separated by a narrow isthmus. The enamel is thick, black and shining, and though it appears to have originally been more or less rough, yet it is now nearly smooth. The measurements of the specimen in its present condition are as follows:

Fore and aft diameter of the crown 10 lines; breadth of posterior lobe obliquely at base of the enameled crown $9\frac{1}{2}$ lines; breadth of anterior lobe in same position $8\frac{1}{4}$ lines; breadth of worn triturating surface of posterior lobe 6 lines; breadth of do. on anterior lobe $5\frac{1}{2}$ lines.

LOPHIODON OCCIDENTALIS.

Dr. Hayden's last collection of Mauvaises Terres fossils contains a last inferior molar tooth which has all the characters ascribed to the corresponding tooth of the extinct tapiroid genus *Lophiodon* of European eocene formations.

The crown is composed of a pair of transverse hill-like lobes, as in the lower molars of the Tapir with the addition of a well developed posterior conoidal talon. The principal lobes have subacute summits slightly concave transversely, their posterior surface sloping, their anterior surface concave, and their exterior sides convex. The talon is about half the height of the principal lobes, convex behind, and with the front surface inclining from the middle on each side. The crown is bounded in front by a basal ridge. Fore and aft diameter of the crown $9\frac{3}{4}$ lines; transverse diameter in front $6\frac{1}{2}$ lines.

I have a suspicion that this specimen belonged to the lowest bed of the

White River tertiary formations, and with associated remains of *Hyopotamus* and *Titanotherium*, probably indicates the end of the eocene, which was succeeded by the more extensive miocene deposits of the Mauvaises Terres, and the pliocene deposits of the Niobrara River.

On some Cretaceous REPTILIA.

BY E. D. COPE.

NATANTIA.

CLIDASTES Cope.

This genus is established on a species represented by a single dorsal vertebra, which was found by my friend Prof. O. C. Marsh, of Yale College, in a marl pit near Swedesboro', Gloucester Co., N. J. Its form is highly characteristic, and resembles considerably that of such genera of Iguanidæ as Euphryne and Dipsosaurus, and in some degree those of Cyclura and Iguana. It differs from the dorsals of known serpents in having a zygosphen on the plane of the anterior zygapophysis, and in having the costal articular surface continuous with and covering the diapophyses. It differs from the genera of Iguanidæ mentioned in the very small amount of upward direction which the face of the articular ball of the centrum exhibits. This face is nearly vertical, meeting the lower plane at a slightly less angle than the upper. It is much more strongly convex transversely than vertically. The neural arch rises from the anterior three-fourths of the centrum, the zygapophysis coming off from the edge of the cup, and the diapophysis from ·2 of the length behind it. The zygapophysis is more prominent than the zygosphen, and the sinus between them is floored by a thin horizontal plate at its fundus.

The general form of the vertebra is depressed. The zygapophyses are spread apart, and their outer margin continues in a straight line from the diapophyses. The diapophyses are directed upwards, and are vertical compressed in form; they are opposite to about equal portions of the centrum and neural arch. Their posterior face is slightly concave, and the upper face behind forms, with the neural arch, a deeply concave line. The convexity of the ball is not so great as in the Crocodilia, and, with the thin lipped cup, resembles that of Mosasaurus; this resemblance is heightened by the slightly depressed upper outline of the ball, and the form of the diapophyses. The inferior face of the centrum presents a median obtuse ridge, and nearly flat lateral faces, which are concave antero-posteriorly. The cup is broader than deep, and has a slightly concave outline; the base of the zygosphen originates opposite the middle of the neural canal. The latter is a broad vertical oval.

CLIDASTES IGUANAVUS Cope, sp. nov.

In this species the articular face of the zygosphen is inclined at an angle of 45°, while that of the zygapophysis is a little more horizontal. The posterior zygapophyses are broken off.

	In.	Lin.
Length of centrum below	2	0·5
Width of cup	1	6·8
Depth "	1	1·5
Width between extremities diapophysis	3	0·5
Depth articular face diapophyses.		10·5
From diapophysis to end zygapophysis		9
Between zygosphen and zygapophysis		4·5
Width centrum anterior to ball		15
Width of neural canal behind		5·5

While there is a probability that this animal was a forerunner of the Iguanian type of Lacertilia, it possessed, no doubt, strong relationships to Mosasaurus. Its nearest ally is Macrosaurus, in some of the vertebræ of which a slight groove, beside the zygapophysis, is the rudiment of the zygantrum. If of the same proportions as Iguana and Amblyrhynchus, its length would not have been much different from twelve feet, or that of the largest alligators of the Mississippi.

OPHIDIA.

PALÆOPHIS Owen.

PALÆOPHIS LITTORALIS Cope. Proc. Acad. Nat. Sci. Philad. 1868, 147.

This, with the following, is the only serpent whose remains have been found in the United States in deposits older than the post-pliocene. We owe its preservation to Dr. Knieskern, of Shark River, N. J., best known by his botanical investigations. It is in possession of the New Jersey State Geological Survey, and has been submitted to me by Prof. Geo. H. Cook, the Director, for examination. The specimens consist of three vertebræ, neither of them perfect; the most so with neural arch, but with diapophyses broken off.

The more perfect is an anterior dorsal, with two hypapophyses, the anterior small and directed forwards, the posterior larger, and directed vertically downwards. The ball has some superior up-look, though the groove which bounds it is but little oblique. Centrum much compressed behind the middle. Plane of basis of zygapophysis opposite floor of neural arch; zygapophysis directed slightly upwards and outwards, continuous by a broad wing running posteriorly, with the diapophysis. Neural arch well elevated, (broken off behind). The basis of the neural spine is narrow on the anterior part of the arch, and does not reach the anterior margin.

	Lin.
Length centrum (ball to edge cup)	8·25
Depth ball	4·25
Width "	5·
" between extremities of zygapophyses	8·
Depth cup and neural arch	7·5
Width neural arch behind	2·25

A strong ridge extends from the zygapophysis posteriorly parallel with the centrum. There is no ridge continued from the zygosphen. Except a slight ridge below the fossa, which is above and back of the diapophysis, the surface of the vertebra is smooth.

Another vertebra is rather broader in proportion to its length, and less compressed.

	Lin.
Length (as above)	7·8
Width ball	5

In both the ball has a subtriangular outline. In the more perfect, the base of the neural canal is divided by a narrow longitudinal epapophysis.

Locality.—The eocene green sand bed of Shark River, Monmouth Co., N. J.

PALÆOPHIS HALIDANUS Cope, sp. nov.

A single vertebra represents this species. It indicates one of the largest of the genus, being little different from the P. typhæus of Owen in size. The bulk of the vertebra is double that of the P. littoralis. In addition to this point, it differs from the latter in the greater transverse diameter of the cup and ball; these are transversely oval; in the P. littoralis subtriangular ovate; the centrum is naturally less constricted and broader in the former. The articular face of the zygapophysis is broadly ovate in the P. halidanus, narrowly in the smaller species; while there are indications of similar posterior hypapophysis in both, the anterior in the P. halidanus appears to have been smaller.

As compared with the species described by Owen, the cup and ball are more transverse than in any noticed in the British Fossil Reptiles, approaching that figured by him in pl. 3, fig. 22–4; the ball has not the oblique, up-looking profile of that species, but forms a nearly regular arc, with its posterior margin superiorly a little behind its position inferiorly. The hypapophysial ridge is considerably interrupted, as in the P. typhæus, while P. littoralis agrees with the P. toliapicus in having it continuous. The two last named species differ in the development of their hypapophyses; in the American species both are large, especially the posterior; in the English, the anterior process is weak or wanting; the ridge connecting the zygapophyses disappears in the P. toliapicus and continues in the P. littoralis. The general proportions of the centrum are slender, as in P. toliapicus, and not so stout as in P. porcatus Owen.

The diapophyses in the P. halidanus are not so pedunculate as in P. typhæus, though they are separated above by a notch from the vertical ala which descends from the zygapophysis, which I do not find in the P. littoralis They approach near the margin of the cup in their transverse extent below.

The horizontal ridge between the zygapophyses is strongly marked, and in the specimen in hand comes off from the anterior vertical ala below the zygapophysis, rather than from the plane of that process, as in P. littoralis. The neural canal is depressed behind, below the margin of the ball, and has an obtuse epapophysis along the median region of its median line. There is no ridge parallel to the hypapophysis. The cup is partially broken, but its transverse diameter appears to have been one-fourth greater than the vertical. The transverse plane of the face of the zygapophysis is transverse. A large part of the neural arch is broken away.

	Lines.
Length from edge up to convexity of ball	12·75
Width between anterior zygapophyses	13·5
" of cup	8·4
Depth "	6·2
Least width centrum at middle	5·3
Width neural canal	4·

Locality.—This serpent was found by my friend O. B. Kinney in the excavations of the Squankum Marl Company, at Squankum, Monmouth Co., N. J., a few miles south of Shark River. The horizon is eocene.

This animal was probably a sea-serpent distantly allied to the Boas, and far exceeding in dimensions those at present inhabiting the Indian Ocean. Its size was similar to that of the very largest of terrestrial serpents of the modern era, and was probably proportioned to a length of twenty feet.

CHELONIA.

ADOCUS Cope.

Emydoid tortoises, in which the rib-heads of the posterior costal bones are represented by rudimental laminæ, and the anterior by a crest or truncate ridge in addition. Vertebral scuta narrow; external surfaces smooth or nearly so.

Name from Α, and Δοκος, rafter (*i. e.*, rib-head).

This genus, now first characterized, differs from Emys in the absence of costal capitula of the costal plates of the carapace, a feature pointed out by Leidy in the type species. It also possesses a character of Pleurosternum in the presence of a series of marginal dermal plates on the sternal bridge. It belongs to the true Emydidæ, having the eight paired sternal bones instead of ten of the first-mentioned. The markings of the dermal plates of the plastron are not distinct. Besides the species here described, it includes A. beatus (Emys Leidy), A. firmus (Emys Leidy), A. pravus (Emys Leidy), and A. agilis Cope. It represents Emys in our cretaceous, as Osteopygis Cope does Chelydra, and Taphrosphys Cope (type Platemys sulcatus Leidy) does Hydraspis.

Adocus petrosus Cope.

This species is represented by portions of four costal bones, parts or wholes of six marginal bones, most of the right hyosternal, and a posterior portion of the right hyposternal, with the head of the os coracoideum. They were found in the West Jersey Marl Company's pits, Gloucester Co., N. J., in the same locality whence the Lælaps was procured.

The hyosternal bone is preserved in its axillary margin, and is continuous with two marginals of the carapace of the same side. Two of the costals are adjacent, and give the outlines of the vertebral bones and scutes. These show the inferior outline to be very convex, the whole, from angle to angle of the marginal bones of opposite sides, amounting to an arc of about 124 degrees. Each hyosternal is slightly concave below the plane of their common suture. Each thins out laterally, though the one preserved is very thick on the axillary margin. There is little difference between the thickness at the mesosternal and hyposternal sutures. All the sutures have minute rugosities, differing much from sternals in A. agilis and Taphrosphys, which are very ragged, and resembling those of Pleurosternum pectorale m. The piece of hyposternal is even thicker than the hyosternal. The bone is everywhere remarkable for the thickness of its dense layer, and the closeness of the texture of the spongy. The former is one-third the thickness of the sternal and costal bones fractured.

The scute sutures of the inferior surface are obsolete; those of the dorsal surface are like those of Adocus, *i. e.*, the vertebrals with bracket-shaped lateral borders, with the costal proceeding from the point of the bracket.

The marginal bones vary much in thickness proximally. They have two proximal sutures, one side convex, the other concave. Four have a heavy border, round in section; in two of these it is considerably everted. Another has a rather thin margin, slightly decurved, with a submarginal groove separating it from the most massive portion. The costal bones are strongly convex in their length, indicating an arched carapace.

Measurements.

	In.	Lin.
Hyosternal width	3	9
" " to origin axillary abutment	2	1·5
" length on median suture	2	1·5
" thickness near mesosternal line		9
" " " hyposternal "		7·2
Hyposternal thickness near posterior suture		9
Costal width	1	7·5
" thickness vertebral suture		8
Marginal No. 1 width	2	1·5
" " length	1	7
" " proximal thickness		3
" No. 5 " "		8·2
" " length	1	6
" " width	1	7·5
" " width dermal scute		9

This animal is therefore a species of considerable size, though less than most of those described here, and particularly convex and solid in every part. While the sutural lines of the hyosternal measure about the same as in A. firmus (Emys Leidy), it is much more convex and not so thick at the mesosternal suture. The marginal bones are relatively just half the size. The Pleurosternum pectorale differs in being very much flatter, and in having a more discoid mesosternal bone. The hyosternals are also much thicker at their union with the marginals than in the present.

A portion of a hyo- or hyposternal bone collected at the same place, and near or at the same time, may be referred to a larger individual of the same species or to A. firmus. It exhibits a wedge for a diagonal gomphosis between the two sutures, which are preserved. The thickness on the median suture is 14 lines.

DINOSAURIA.

LÆLAPS Cope.

LÆLAPS AQUILUNGUIS Cope.

External form and position in Lælaps.

The short fore-limbs of this genus suggest at once the habit of standing upon the hind limbs chiefly, yet this disproportion is no sufficient reason therefor, and is seen to exist in the tailless Batrachia, where no such position is assumed. It exists to a less degree among the modern lizards, whose position we well know to be always horizontal.

Lælaps had, however, no doubt an erect position, for the following reason: The head and neck of the femur are at right angles to the direction of motion on the condyles, or in the same plane as the transverse direction of the condyles. This indicates that the femur has been reflexed and extended in a plane parallel with that of the vertebral column. The relations of articulation are those of birds, and different from those of reptiles, where the directions of the proximal and distal condyles of the femur are oblique to each other, and the proximal of a vertically elongate form, thus allowing the femur to be obliquely directed as regards the axis of the body, so that in a prone position it rested on the ground equally clear of the body and the flexed tibia.

The resemblance of the tibia, with its high crest and embracing astragalus, as well as the slender fibula, to those of the birds, confirms this position; so do types of the iliac and sacral structures. The same is suggested by the great bird-like reptile tracks found in many places.

How must a reptilian form with elongate vertebral column and heavy tooth-bearing cranium have stood erect? The elongate form of the femur as compared with the tibia is only seen among animals who walk erect, in man; in the birds and kangaroos the femur is very much shorter than the tibia; besides these no other vertebrates progress on the hind limbs entirely. The lizards, which are prone, present the long femur exceeding or equalling the tibia.

The bird-like reptile did not, however, exhibit the slight flexure between femur and tibia presented by man. The acetabulum in the known Dinosaurs is not or but weakly completed below, or what would be in man anteriorly, indicating that the weight of the body was supported by a femur placed at a strong angle with the longitudinal axis of the ilium; otherwise the head of the femur would be most readily displaced. If, therefore, the ilium were more or less erect, the femur was directed forwards; if horizontal, the femur must have projected downwards. I have shown, however, that the position and therefore the ilium was oblique or erect; therefore the femur was directed very much forwards.*

There are, however, other reasons for believing that the femur was directed forwards, and somewhat upwards from the ilium. One is, that the centre of gravity of an elongate reptilian dorsal and sternal region must have been further forwards than in the short-bodied bird, and therefore the knee must have been further forward, in order to bring the support—*i. e*, the tibia, etc.—beneath it. Another is, that the articulation of the tarso-metatarsal bones with

* The remarks of Prof. Owen on this relation in Megalosaurus are so pertinent, that they are introduced here:

"The backward position and production of the corresponding articular prominences or condyles in both femur and tibia, indicate that these bones were joined together at an angle, probably approaching a right one, when in their intermediate state between flexion and extension; and that the motion of the tibia could not have taken place to the extent required to bring the two bones to the same line."

the tibia is excessively oblique, requiring that one or both sections of the limb should be very oblique to the vertical line. As the tarso-metatarsal elements support the weight immediately on the ground, and as it is obvious that the leverage moving the great weight of the body on its support must have been the gastrocnemius and soleus muscles extending the tibia on the metatarsal segment as the fixed point, and as there is no indication of correspondingly powerful muscles to flex the metatarsals on the phalanges, it is obvious that the latter has been the more vertical, and the former the more oblique segment. And if the tibial segment has been oblique, for reasons just given, the femur must have been oblique also.*

The length of the femur has had relation to another peculiarity as well, as follows:

In an animal designed to walk erect, it is necessary that the centre of gravity should be transferred as far posteriorly as is consistent with the type. In Lælaps and other Dinosauria we have very elongate pubic and iliac bones, and, as I have before described, these appear to have been designed to enclose and support an abdominal mass, in a position beneath the sacrum, and posterior to the position observed in quadrupedal mammals and reptiles. We would thus have a prominent keeled belly between the femora, supported by elongate curved ischia behind, and slender pubes directed downwards in front. In Poecilopleurum the space between the latter and the sternum was occupied by abdominal ribs. The length of femur places the arc through which the knee moves beyond this projection.

The confluence of a greater number of vertebræ to form a sacrum, seen in this order and in the birds, would seem to have a direct relation to the support of the above-mentioned greater weight by it, than in horizontal vertebrata, where the weight is distributed throughout the length of the vertebral column.

The shifting of the neural arches backwards, seen in the same orders, pointed out by Owen, would have a mechanical relation to the same necessity,—*i. e.*, their partial transfer over the intervertebral spaces naturally tending to strengthen the union of the sacral elements.

The foot need not, however, have been placed precisely beneath the centre of gravity of the body, as the animal was furnished with a tail of greater or less weight. This member bears, however, little proportion to the great size of those seen in Iguanodon, Hadrosaurus, etc., but exhibits a commencement of the reduction which is so striking among the birds.

The proportions of the metatarsus are only to be ascertained by an examination of those of allied species, as L. macropus and Megalosaurus bucklandii. As all the other bones are more slender than those of the latter, so were no doubt these bones longer in proportion to their breadth. I have estimated it above as equal to a little over half the tibia.

The digits in the genus Lælaps have not, in all probability, been more than four. The less bird-like forms of Hylæosaurus and Iguanodon have had, according to Owen, but three metatarsals, and it is not according to the *rule of successional relation* that there should be any repetition of a reptilian character, in a point of prime importance in measuring the steps of succession between reptiles and birds. Lælaps, and probably Megalosaurus also, had but three digits directed anteriorly, and a fourth lateral or rudimental.

It is true that Deslongchamps ascribes five digits to Pœcilopleurum, after a careful study of abundant material. He was, however, much more impressed with the Crocodilian affinities of that reptile than with any other, and did not recognize the avine in the astragalus. It seems to me quite possible that one of his toes can be dispensed with,—for example, the second, of which but one phalange is said to remain. If we ascribe the fractured extremity of the bone

* Probably in a squatting posture the animal rested on the entire sole as far as the heel, though not under ordinary circumstances; as I have suggested in Amer. Naturalist, i, 28, Mycteria and other wading birds assume a similar position at times.

regarded (Tab. viii, fig. 6) as the first phalange of the fourth digit, to the metatarsal of the same, the phalange referred to the second may find another place. The fifth digit also rests on the evidence of one phalange only. Though the reasoning of Deslongchamps in referring these pieces is good, it seems to me that renewed study might result in ascribing to this genus three toes anteriorly and one appendicular,—his first.

The predominance of Reptilian characters in the Dinosauria, as indicated by the structure of the vertebræ and other points, renders it probable that the vertebral column did not present that remarkable flexure where the cervical and dorsal series are joined, which is seen in the birds, but rather that they were more or less continuous, and formed a continuum from the sacrum to the nape. The cervicals may have been somewhat elongated, as in some birds, yet this is not probable in view of the necessary balance to be preserved, which would not admit of much projection of the cranium anteriorly. The cervicals of Hadrosaurus are not so long as in the modern Varani; in Iguanodon they are similar, while their rather oblique articular faces indicate the elevation of that region, and of the position of the cranium. In the case of these animals, there is not the same necessity for a long neck as in the birds, for even in Lælaps and other genera which probably never used the fore limbs in progression, they furnished a support to the body when the head was employed in taking food, etc., on the ground.

The caudal region affects the general proportions of a vertebrated animal materially. In Lælaps it is shorter than in any known Dinosaur, measuring less than the hind limb by half a foot. It was cylindrical, slender towards the tip, and in fact not unlike that of a dog, and probably capable of motion similar to the latter. When the Lælaps stood erect, the tail would trail its extremity on the ground, but could furnish little support.

Comparison with other Dinosauria.

The species with which detailed comparisons can be made, are the Pœcilopleurum bucklandii Deslongchamps, and Megalosaurus bucklandii Mantell. All three were of nearly similar size. The Pœcilopleurum is better known than the Megalosaurus, and furnishes many similar parts. Thus the humeri possess the same disproportionately small size, the extremity of the tibia is similarly expanded and flattened, and is similarly embraced by the astragalus. There are, however, abundant specific differences in all the bones described by Deslongchamps. In the same manner the Lælaps aquilunguis presents abundant specific differences from the Megalosaurus bucklandii. The slender curved femur differs from the massive straight one of the latter; the tibia is more slender, and more flattened distally; its extremity is wedge-shaped, not rhombic as in the European species. The claws of Megalosaurus are relatively shorter and less curved.

The generic relations with these two types must be understood. Lælaps is obviously distinct from Pœcilopleurum in the structure of its feet. In the former the phalanges are slender, in the latter massive, and mostly broad. The claws are more different; in the former compressed and hooked; as broad as deep in the latter, and but little curved. They are prehensile in the former, in the latter not at all, or adapted only for defense; they present a very small point of insertion, compared with the large knob of the former; they also exhibit a deep groove on the side, which is weak in Lælaps. The difference in this respect is about that between a raptorial and rasorial bird.

As compared with Megalosaurus, Lælaps probably had very short fore-limbs. I have pointed out the difference in the femur, which is perhaps not more than specific, though this cannot be positively asserted. The difference in the form of the extremity of the tibia I suspect also to indicate more than specific difference. The bone described by Owen (Palæontographical Society) as scapula, furnishes means of estimating the size of the humerus. The glenoid cavity is some six inches in diameter, indicating a humerus of four times the size of that of Lælaps at least. The claws also of the Megalosaurus are intermediate between those of Lælaps and Pœcilopleurum, being less compressed and hooked than in the first.

Size.—In estimating the length of this reptile we have the lengths of the limbs and tail, and proportions of parts of the jaws to rely on. There is some reason to believe that the lengths of the hind leg and of the tail were similar. In erect animals, as the Kangaroo and Ostrich, the length of the vertebral column anterior to the sacrum about equals the length of the hind limb. In the present form the limb is increased by the greater length of the femur than in either, but is shorter than that of the bird by the abbreviation of the metatarsals. The proportions would then remain about the same as in the bird, were it not that a head larger than in that class has evidently been borne upon the cervical vertebræ, more as in the Kangaroo. It appears then that the increased length of the femur in Lælaps may be added to the proportions of the Kangaroo, thus giving a nearer equality between the lengths of the hind limb and the body and head together. The length would then be seventeen feet, divided as follows:

	Ft.	In.
Tail	8	6
Body and neck	6	6
Head	2	
Total	17	

This is probably the size of the Barnesboro individual, which is in all probability young, as the sacral vertebræ are entirely disunited. The phalange from Mississippi, above described, is very much larger than any of the former, and may have belonged to an adult animal. In any case it indicates a gigantic reptile of twenty-three feet or more in length.

The femur of the young individual is as long as that described by Owen (Palæontographica) as belonging to Megalosaurus. As that genus was probably more bulky anteriorly than Lælaps, its length, as compared with the dimensions of the hind limb, is greater. If, however, it approached Lælaps in proportions, as is probable, the length of thirty feet assigned to it appears too great. In fact it cannot have been larger than the Mississippi, or adult Lælaps aquilunguis.

Thus the original estimate of the lengths of these carnivorous Dinosaurs is still further reduced. Owen accomplished part of this by estimating on the mammalian and rejecting the reptilian type; the introduction of the avine element places the proportion at about the proper point in respect to the Goniopoda at least.

The elevation of the head of Lælaps would no doubt depend more upon the pleasure of the animal, than in a more quadrupedal form. Nine feet above the ground is a probable estimate for the young one, and twelve for the adult.

Movements.—The mind will picture to itself the actions and habits of such strange monsters as the Dinosauria, and in respect to some of the genera there is considerable basis for speculation.

That monsters walking on two posterior limbs have inhabited the earth, has been familiar to all since the publication, by Hitchcock and Deane, of the histories of the great foot-tracks of the Triassic Red Sandstone of the Connecticut valley. Such tracks have been discovered by Jno. Smock, in the same formation, in New Jersey, and by Dr. Chas. Hitchcock in Pennsylvania. Prof. Hitchcock ascribed the tracks described by him to birds. Prof. Agassiz* expresses the belief that they were made by vertebrates combining characters of existing classes, perhaps of reptiles and mammals, rather than by birds. Now a carnivorous Dinosaur probably allied to Lælaps, as proven by a portion of

* Contrib. Nat. Hist. U. S., 1857, vol. i.

the jaw with teeth, in the Academy's Museum, the Bathygnathus borealis of Leidy, has left its remains in the red sandstone of Prince Edward's Island, of the same age, and we safely conclude that some of the large-clawed biped tracks of Hitchcock are those of that animal. Dr. Leidy has suspected that this would prove to be the case, as he asks* "was this animal probably not one of the bipeds which made the so-called bird tracks in the sandstone of the Connecticut valley?" This enquiry was, after an examination of the form of Lælaps, answered in the affirmative.† I have ascribed these tracks to reptiles allied to Lælaps, and Huxley believes also that they were made by Dinosauria.‡

The creatures which strode along the flats of the Triassic estuary have been various in species and genera, as pointed out by Hitchcock. Some were purely biped; some occasionally supported themselves on a pair of reduced fore-limbs. There are impressions where these creatures have squatted on their haunches. One can well imagine the singular effect which these huge gregarious reptiles would produce, standing motionless, goblin-like, on a horizon lit by a full moon; or lying with outstretched neck and ponderous haunches basking in the noonday sun; or marching or wading slowly along the water's edge, ready for a plunge at passing fishes or swimming reptiles. But in the active pursuit of terrestrial prey did such an animal as the Lælaps run like the Ostrich, or leap like the Kangaroo? So far as the Triassic tracks go, there is no evidence of leapers, only runners, fell upon an exhausted quarry. Or were they only carrion eaters, tearing and devouring the dead of age and disease? Probably some were such, but the prehensile claws of Lælaps are like instruments for holding living prey.

Lælaps has a long femur; those great leapers the Kangaroos have a short one; the cursorial birds, however, have a similar form of femur, but they do not leap. So this form is not conclusive. The modern Iguanas have long femora, and they all progress by their simultaneous motion; they only leap; but man with his long femur runs only. The question then does not depend on the form of the femur.

I have suggested on a former occasion that Lælaps took enormous leaps and struck its prey with its hind limbs. I say, in describing it, "The small size of the fore limbs must have rendered them far less efficient as weapons than the hind feet, in an attack on such a creature as Hadrosaurus; hence perhaps the latter were preferred in inflicting fatal wounds. The ornithic type of sacrum elucidated by Prof. Owen suggests a resemblance in the use of the limb."

The lightness and hollowness of the bones of the *Lælaps* arrest the attention. This is especially true of the long bones of the hind limbs; those of the fore limbs have a less considerable medullary cavity. In this respect they are quite similar to those of Cœlosaurus Leidy, of which its describer remarks, "that the medullary cavity of the tibia is large, and the walls thin and dense," "being intermediate in this respect between the characters of the mammals and birds."

The mutual flexure, as well as the lightness and strength of the great femur and tibia, are altogether appropriate to great powers of leaping. The feet must have been elongate, whatever the form of the tarsi; the phalanges, or finger bones, were slender, nearly as much so relatively as those of an eagle, while the great claws in which they terminated were relatively larger and more compressed than in the birds of prey. There was no provision for the retractibility observed in the great carnivorous mammalia, but the size of the inferior basal tuberosity indicates the insertion of a great tendon of a powerful flexor muscle. The slight grooves at the base, and deeper one on each side of the phalange, suggest the usual horny sheath, which, prolonging the point of the claw, would give it a total length of eleven inches.

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* Journal Acad. Nat. Sciences, 1854, 329.

† American Naturalist, 1867, 27. Hay's Medical News and Reporter, 1868.

‡ Proceedings Royal Society, London, 1868, p. Natural Science Review, 1868.

The fore limbs must indeed have been of very little use, and it is very difficult to imagine an animal running and seizing the prey it overtakes with the hind limb. If it were not a carrion feeder it must have leaped. We are informed by Hochstetter,* that the Apteryx leaps with the utmost ease over objects two and three feet in height, that is, higher than its own head. Huxley suggests that the Compsognathus "hopped" along on its hind limbs. The bulk of Lælaps is no objection to its leaping, for the giant extinct Kangaroos, Macropus atlas and titan, found in the postpliocenes of Australia, did not fall far short of these reptiles in this respect. We may add that Lælaps had smaller allies, as L. macropus one-half, and Cœlosaurus antiquus one-fourth or fifth the size, whose remains, so far as they go, indicate an identity of habit. Deslongchamps says of Pœcilopleurum bucklandii, that it "could project itself with prodigious force, as a spring which unbends itself; but this could not have been on a solid surface, since the fore limbs are too weak to resist the shock of the fall of such a heavy body." He supposed it to be marine in its habits, accustomed to battling a stormy sea. However, his objection to leaping on land is obviated by understanding that progressive movement was entirely performed by the hind limbs.

On the Origin of GENERA.

BY EDWARD D. COPE, A.M.

Introduction.—The present fragmentary essay is a portion of what other occupation has prevented the author from completing. It does not therefore amount to a complete demonstration of the points in question, but it is hoped that it may aid some in a classification of facts with a reference to their signification. When all the vast array of facts in possession of the many more learned than the writer, are so arranged, a *demonstration* of the origin of species may be looked for somewhere in the direction here attempted to be followed.

Conclusions of any kind will scarcely be reached, either by anatomists who neglect specific and generic characters, or secondly by systematists who in like manner neglect internal structure. Such will never perceive the system of nature.†

Analysis of the subject.

I. Relations of allied genera.
  First; in adult age.
  Second; in relation to their development.
    α. On exact parallelism.
    β. On inexact or remote parallelism.
    γ. On parallelism in higher groups.
    δ. On the extent of parallelisms.
II. Of retardation and acceleration in generic characters.
  First; metamorphoses in adult age.
    α. The developmental relations of generic and specific characters.
    β. Probable cases of transition.
    γ. Ascertained cases of transition.
  Second; earlier metamorphoses.
    δ. The origin of inexact parallelisms.

* New Zealand Amer. Transl., 181.

† It might seem incredible that either class should systematize with confidence, yet a justly esteemed author writes even at the present day, "However, there is scarcely a systematist of the present day who does not pay more or less attention to *anatomical* characters, in establishing the higher groups!" (The italics are our own,) As though a system was of any value which is not based on the *whole structure*, and as though *lower* groups were only visible in external characters: in a word, as though external (muco-dermal, dental, etc.) characters were not "anatomical!"

III. Relations of higher groups.
- α. Of homologous groups.
- β. Of heterology.
- γ. Of mimetic analogy.

IV. Of natural selection.
- α. As affecting class and ordinal characters.
- β. As affecting family characters.
- γ. As affecting generic characters.
- δ. As affecting specific characters.
- ε On metaphysical species.

V. Of epochal relations.

The laws which have regulated the successive creation of organic beings will be found to be of two kinds, as it appears to the writer. The first, that which has impelled matter to produce numberless ultimate types from common origins; second, that which expresses the mode or manner in which this first law has executed its course, from its commencement to its determined end, in the many cases before us.

That a descent, with modifications, has progressed from the beginning of the creation, is exceedingly probable. The best enumerations of facts and arguments in its favor are those of Darwin, as given in his various important works, The Origin of Species, etc. There are, however, some views respecting the laws of development on which he does not dwell, and which it is proposed here to point out.*

In the first place, it is an undoubted fact that the origin of genera is a more distinct subject from the origin of species than has been supposed.

A descent with modification involves continuous series of organic types through one or many geologic ages, and the co-existence of such parts of such various series at one time as the law of mutual adaptation may permit.

These series, as now found, are of two kinds; the uninterrupted line of specific, and the same uninterrupted line of generic characters. These are independent of each other, and have not, it appears to the writer, been developed pari passu. As a general law it is proposed to render highly probable that the same specific form has existed through a succession of genera, and perhaps in different epochs of geologic time.

With regard to the first law of development, as above proposed, no one has found means of discovering it, and perhaps no one ever will. It would answer such questions as this. What necessary coincidence of forces has resulted in the terminus of the series of fishes in the perches as its most specialized extreme; or, of the Batrachia, in the fresh-water frogs, as its ultimum; or, of the thrushes, among birds, as their highest extreme: in a word, what necessity resulted in man as the crown of the Mammalian series, instead of some other organic type? Our only answer and law for these questions must be, the will of the Creator.

The second law, of modes and means, has been represented to be that of natural selection by Darwin. This is, in brief, that the will of the animal, applied to its body, in the search for means of subsistence and protection from injuries, gradually produces those features which are evidently adaptive in their nature. That, in addition, a disposition to a general variation on the part of *species* has been met by the greater or less adaptation of the results of such variation to the varying necessities of their respective situations. That the result of such conflict has been the extinction of those types that are not adapted to their immediate or changed conditions, and the preservation of those that are.

In determining those characters of plants and animals, which constitute them what they are, we have, among others of higher import, those which constitute them species and those which constitute them genera. What we propose is: that of the latter, comparatively very few in the whole range of animals and plants are *adaptations* to external needs or forces,—and of the former a large proportion are of the same kind. How then could they owe their existence to a process regulated by adaptation?

Darwin is aware of these facts to some degree, but, as already said, he does not dwell on them. Where he does, he does not attempt to account for them on the principle of natural selection.

There are, it appears to us, two laws of means and modes of development. I. The law of acceleration and retardation. II. The law of natural selectiou.

It is my purpose to show that these propositions are distinct, and not one a part of the other: in brief, that while natuial selection operates by the "preservation of the fittest," retardation and acceleration act without any reference to "fitness" at all; that instead of being controlled by fitness, it is the controller of fitness. Perhaps all the characteristics supposed to mark generalized groups from genera up (excepting, perhaps, families), to have been evolved under the first mode, combined with some intervention of the second, and that specific characters or *species* have been evolved by a combination of a lesser degree of the first with a greater degree of the second mode.

I propose to bring forward some facts and propositions in the present essay illustrative of the first mode.

I. *On the relations of nearly allied genera.*

First. The writer's views of the relations of genera have already been given at the close of an Essay on the Cyprinoid Fishes of Pennsylvania.* It is easy enough to define isolated genera which have few immediate affines, but among extensive series of related forms the case is different. One principle, however, pervades the conception and practice of all zoologists and botanists, which few take pains to analyse or explain. It is simply that they observe a successional relation of groups, by which they pass from one type of structure to one or several other types, and the presence or absence of the steps in this succession they regard as definitions of the genera.

It is true that the reader will often find introduced into diagnoses of genera, characters which indicate nothing of this sort. It is often necessary, indeed, to introduce characters which are not peculiar to the genus characterized, for the sake of distinguishing it from similar ones of *other series*, but this only in an imperfect state of the record. Moreover, the ability of the writer to distinguish genera being thus tested, he too often fails by introducing family and specific characters, or by indulging in an unnecessary redundancy. In general it may be said that adjacent genera of the same series differ from each other by but a single character; and generally, that the more remote differ by characters as numerous as the stages of their remove.

It is precisely as, among the inorganic elements, we pass from the electronegative, non-oxidizing extreme of the Halogens, with Fluorine as the extreme, to the electro-positive, violently oxidizing extreme of the alkaline metals, whose extreme is potassium, by steps whose relative position is measured or determined first by these tests; and as these steps have each their included series of bodies, characterized by their successive relations on the lower level of a subordinate range of characters. This principle is distinctly admitted by many zoologists;† those who deny it generally failing to perceive it because they attempt to guage a major scale by characters which are really the test of one or all of the subordinate or included scales. It holds true of most of the groups of organic beings; thus the class is a scale of orders, the order of tribes. I will not now say that the tribe is a scale of families, as the case is here much modified, but what is chiefly to be considered in this essay, is that the family is composed of one or several scales of genera.

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* Trans. Amer. Philos. Soc., 1866, from Proc. Acad. Nat. Sci., Phil., 1859, 332.

† Prof. Bronn, in his Classen u. Ordnungen des Thierreiches, has everywhere a chapter on Die aufsteigende Reihe,—"the ascending scale."

Second. Now, the more nearly allied genera are, the more surely will these generic steps be found to fall into the direct line of the steps of the development of the highest, or that with the longest scale, the former being truly identical with the latter in generic characters. Less allied genera will offer an inexact or incomplete imitation of such identity,—some additional character being present to disturb it. Such genus belongs to another series, characterized by the disturbing feature, whose members, however, bear to each other the relation claimed above for such.

The relation of genera, which are simply steps in one and the same line of development, may be called *exact parallelism*, while that of those where one or more characters intervene in the maturity of either the lower or higher genus to destroy identity, may be called *incomplete parallelism.*

The latter relation has been dwelt on by Von Bär, Agassiz and other writers, but none have accepted the existence of *exact parallelism*, or seen its important relation to the origin of genera.

Third. That the lowest or most generalized terms or genera of a number of allied series, will stand to each other in a relation of exact parallelism. That is, if we trace each series of a number, up to its lowest or most generalized genus, the latter together will form a series, similar in kind to each of the subseries; *i. e.* each genus will be identical with the undeveloped conditions of that which progresses the farthest, in respect, of course, to the characters which define it as a series.

Those characters of the skeleton which we are accustomed to call embryonic, are only so because they relate to the developmental succession witnessed in animals at the present time. Characters not so called now were probably as much so at one period now passed. Hence embryonic characters of the bony system do not, as I have often had occasion to observe, characterize the types of the highest rank, but only subordinate divisions of them. Thus the Elasmobranchs are probably repressed forms of groups of a really higher grade than the bony fishes, or Teleostei, which may be known to us. In their early presence in the geologic series we have evidence of the first beginning of a higher type.

In the same manner it has been discovered that the molecular constitution of the elementary substances do not characterize their highest or most distinct series, but rather the substances themselves within the lower group or family to which they belong. The gaseous, liquid and solid molecular conditions being characters distinguishing otherwise allied substances in the same way morphologically (we cannot say yet developmentally), as the cartilaginous, osseous and exostosed or dermosseous characters distinguish otherwise nearly allied genera.

The "family" group embraces one or many of such series. If we trace the series in several families to their simplest or most generalized terms or genera, and compare them, we will not find the relation to be one of exact parallelism in the series of the "order," so far as our present knowledge extends, but in a developmental sense, one of divergence from the commencement.

If we could know the simplest known terms or family characters of a number of groups of families, or "orders," we would probably find them to represent a series of exact parallelism, though to find such simplest terms we must go far into past periods, since the higher the group the more extensive the range of its character, and the less likely to be found unmixed with additions and extensions, in modern times.

Finally, the series of classes is in the relation of the essential characters of the same, as expressed in their now extinct, most generalized and simple representatives, also one of "exact parallelism."

α. Examples of exact parallelism.

* In generic series.

1. As an example we may take the genus Trachycephalus (Batrachia Anura).

Nearly allied to it is the genus Osteocephalus, which differs in the normal exostosis of the cranium not involving the derm, as in the former. Close to this is Scytopis, where the fully ossified cranium is not covered by an exostosis. Next below Scytopis is Hyla, where the upper surface of the cranium is not ossified at all, but is a membranous roof over a great fontanelle. Still more imperfect is Hylella,* which differs from Hyla in the absence of vomerine teeth. Now the genus Trachycephalus, after losing its tail and branchiæ, possesses all the characters of the genus Hylella and those of Hyla, either at or just before the mature state of the latter, as the ethmoid bone is not always ossified in advance of the parietals. It soon, however, becomes a Scytopis, next an Osteocephalus, and finally a Trachycephalus. It belongs successively to these genera, for an exhaustive anatomical examination has failed to reveal any characters by which, during these stages, it could be distinguished from these genera.

Now it would be a false comparison to say that the young of Trachycephalus was identical with the genus Agalychnis, which in truth it resembles, because that genus is furnished with one other character,—the presence of a vertical pupil,—and belongs to another series in consequence, which is represented as yet, with our present imperfect knowledge,—or perhaps imperfect fauna,—by three genera only.

2. The lowest type of the near allies of our common fresh-water frogs is the genus Ranula, where the prefrontal bones are narrow strips on each side the ethmoid cartilage; the ethmoid cartilage itself entirely unossified above, and the vomerine teeth very few and on a small elevation. There are two species, R. affinis and R. palmipes. The other species have the ethmoid cartilage ossified above, at least beneath the extremities of the frontoparietals.

Those of the latter most like Ranula possess the same type of narrow prefrontals, separated by a broad area of cartilaginous ethmoid, and fasciculi of teeth. Of this type is Rana delalandii, and probably R. porosissima Steind., of the South Ethiopian region. Other species of the same type extend their vomerine patches into lines; such are R. mascariensis, R. fasciata, R. oxyrhynchus, R. grayi, and other South African species.

The prefrontals are subtriangular, and approach each other more or less in the numerous species of North America and of the Regio Palæarctica, while generally the vomerine teeth are in fascicles or very short series. In the Æthiopian Rana fuscigula the prefrontals unite on the median line, roofing over the ethmoid cartilage and reducing it, while the vomerine teeth are in very short lines.

In the species of the Palæotropical region, Rana tigrina, R. vittigera, R. cyanophlyctis, R. grunniens, R. hexadactyla, R. corrugata, R. ehrenbergii, R. gracilis, and the Æthiopian R. occipitalis, the prefrontals not only unite solidly (the suture remaining on the median line), but extend and closely fit to the fronto parietals. The vomerine series have lengthened out into series.

Now the young of the latter type of Rana (I take as an example the R. tigrina, one of the most abundant and largest of Indian frogs) presents the subtriangular prefrontals neither in contact with each other or with the fronto-parietals, and the vomerine series is much reduced; in fact, it belongs in all respects to the Palæarctic group. I have not examined younger specimens, but have no doubt they are like those of the Palæarctic; the latter, then, in their young stage, are precisely of the type of the Æthiopian Rana, with fasciculate teeth like the young of those of the same region with teeth in series, since the prefrontals are still more reduced, becoming linear. Finally the first stage of the Nearctic Rana, after losing the larval tail, is the genus Ranula, having linear prefrontals, minute vomerine teeth, and the ethmoid ring cartilaginous above

These points of structure are of generic quality, but I have not regarded any

*I refer to H. carnea m., not having Reinhardt and Lütken's type of this genus.

group as sufficiently defined to be so regarded, except Ranula, as the adults of some species appear not to be constant in possessing them. Thus a very large Rana catesbyana sometimes exhibits prefrontals in contact on the median line, while it is difficult to say whether R. areolata of North America is of the Nearctic type so much as of the Æthiopian. Nevertheless the groups are generally quite geographically restricted.

3. A similar relation exists between the genera Hyperolius, Staurois and Heteroglossa in respect to the prefrontal bones and the separation of the outer metatarsi, and—

4. Between Ixalus, Rhacophorus and Polypedates also, in reference to vomerine teeth, bifurcation of last phalange, and dermoössification of the cranium.

5. When the larvæ of certain species of Spelerpes possess branchiæ, they also lack one digit of the hind foot, also the maxillary, nasal and prefrontal bones, and exhibit a broad continuous palatopterygoid arch, in close contact with the parasphenoid. The proötic is separated from the exoccipital by a membranous space, and the exoccipitals themselves are not yet united above the foramen magnum. There is at the same time a series of splenial teeth. Both ceratohyals are confluent, the posterior is present, and there are but three superior hyoid arches. After they lose the branchiæ, the hinder foot, which has four toes only for a time, gradually adds another at first rudimental digit, in the Mexican species; in most North American species the fifth digit appears at an early larval stage. Five digits are finally present in all Spelerpes.

We have thus four combinations of the above characters, at different periods of the life history of certain (but not of all) of the species of Spelerpes. There exist four permanent series of species or genera, equivalent to these stages. The well-known "perennibranchiate" Necturus is nearly identical with the first, Batrachoseps with the second, the half-toed Spelerpes with the third, and the typical Spelerpes is the last.

In one character of generic value only, do I find that Necturus differs from the early larval Spelerpes. It closes the premaxillary fontanelle with which it commences, by an approximation of the premaxillary spines, but not by a sutural union, as takes place in Amblystoma. It thus, in this one point, advances a stage beyond the condition to which Spelerpes attains, though it may be a question whether such a closure without union should not be classed among the specific characters by which N. maculatus differs from the young of the various Spelerpes, as they do from each other. Characters of the latter kind are the following: in N. maculatus the frontals are more deeply emarginate behind; it has little or no ala on the inferior keel of the caudal vertebræ, which is prominent in Spelerpes larvæ.

It may be that the parallelism in the case of Spelerpes is inexact by one character, and that a strictly developmental one; or it may be regarded otherwise.

6. It is well known that the Cervidæ of the old world develope a basal snag of the antler (see Cuvier, Ossem. Fossiles; Gray, Catal Brit. Mus.) at the third year; a majority of those of the New World (genera Cariacus, Subulo) never develop it except in "abnormal" cases in the most vigorous maturity of the most northern Cariacus (C. virginianus); while the South American Subulo retains to adult age the simple horn of the second year of Cervus.

Among the higher Cervidæ, 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.

Returning to the American deer, we have Blastocerus, whose antlers are identical with those of the fourth year of Cariacus.

Now, individuals of the genus Cervus of the second year do not belong to Subulo, because they have not as yet their mature dentition. Rusa, however, is identical with those Cervi whose dentition is complete before they gain the antlers of the fifth year. When the first trace of a snag appears on one beam of Cariacus virginianus, the dentition includes the full number, but there remain $\frac{1}{3}$ milk molars much worn and ready to be shed. Perhaps the snag is developed before these are displaced. If so, the Cariacus is never a Subulo, but there can be little doubt that the young Blastocerus belongs to that genus before its adult characters appear.

7. Leidy states* that certain Perissodactyle remains containing a foot of a horse, contained the teeth of a genus, Merychippus, which has the permanent teeth of Equus, and the deciduous dentition of Anchitherium. He observes "the deciduous and permanent dentitions of both these genera are alike, therefore the new genus is in early life an Anchitherum, and later in life a true horse." This is therefore a case of exact parallelism, always providing that the Merychippus has not added to its immature Equine characters, others in other parts of the body, which invalidate the indentity. In the latter case, it will still be an interesting example of the "inexact parallelism."

8. It is well known that the Cephalopoda form a number of series of remarkable regularity, the advance being in the first place in the complication of the folds of the external margins of the septa, and in the second place in the degree of involution of one or both extremities of the shell to the spiral; third, in the position of the siphon.

Alpheus Hyatt, in an important essay on this subject,† points out that the less complex forms are in many cases identical with the undeveloped conditions of the more complex. He says: "There is a direct connection between the position of a shell in the completed cycle of the life of this order, and its own developement. Those shells occupying the extremes of the cycle" (in time), "the polar forms, being more embryonic than the intermediate forms.‡ The first epoch of the order is especially the era of rounded, and, in the majority of the species, of unornamented shells with simple septa; the second is the era of ornamentation, and the septa are steadily complicating; in the third the complication of the septa, the ornamentation, and the number of species, about twice that of any other epoch, all combine to make it the zenith of developement in the order; the fourth is distinguishable from all the preceding as the era of retrogression in the form, and partially in the septa.

"The four periods of the individual are similarly arranged, and have comparable characteristics. As has been previously stated, the first is rounded and smooth, with simple septa; the second tuberculated, and the septa more complicated; the third was the only one in which the septa, form and ornamentation simultaneously attained the climax of individual complication; the fourth, when amounting to anything more important than the loss of a few ornaments, was marked by a retrogression of the whorl to a more tabular aspect, and by the partial degradation of the septa."

I will here quote an entirely antagonistic statement of Bronn's,§ as follows: In the development of Lamellibranchiate molluscs "it is not possible to estimate the successional changes of one genus by those of another, though nearly related; so diverse are the most significant relations in the manner of progress

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* Proceed. Acad. Nat. Sci., 1858, p. 7.

† Memoirs Boston Soc. N. Hist, 1866, 193.

‡ He adds here: "Although in regard to geological sequence and structural position one of the extremes must be of higher geological rank." The "*highest*" extreme will be of higher geological rank according to the complexity of structure and length of developmental scale, whether it come at the middle or end of the history of the class in time. If, as has been the case so far as known, a decline has terminated the history of a class, its later forms are zoologically *lower* than its older ones. Hence the adjective *high* is only appropriate to types of the latter kind, when used as synonymous with extreme.

§ Classen u. Ordnungen des Thierreichs, iii, 445.

among nearest allies. Therefore embryologic indications are throughout useless in classification, and it is necessary to keep carefully separate the statements of observations on development of a given species, and not transfer such facts to the history of another species for the purpose of completing it. We cannot even range these histories in conformity with family groups." For us this statement, though no doubt largely true, is an indication of imperfection, first, of knowledge of true affinities of recent, but especially of extinct adults, and second, of imperfection of knowledge of development. The position appears to be based on negative evidence, while the opposing can and does stand on nothing but positive.

β. Examples of the inexact parallelism.

1. The genera of the Batrachian family Scaphiopodidæ form a series of steps differing a little more than as repressions or permanent primary conditions in the development of the highest.* Thus two of the genera, which are North American, maintain their tubæ eustachii and tympanum through life, while three European lose them at an early period. The three European genera also advance beyond the larval character of the American in the ossification of the basis of the xiphisternum into a broad style. Thus we have two series established, which differ only in the two characters named. Each shows its developmental steps in a similar manner, the European series extending further; thus,—

	European.	*North American.*
1. Temporal fossa over arched.	Cultripes.	* *
Temporal roof not ossified.		
2 Fronto-parietal bones ossified, involving derm.	Pelobates.	Scaphiopus.
3. Fronto-parietals ossified, distinct from derm.	* * (Unknown.)	* *
4. Fronto parietals not ossified, distinct from derm.	Didocus.	Spea.

In this case Didocus cannot be said to be identical as a genus with an undeveloped stage of Cultripes, since while the cranium of the latter is in the condition of Didocus it bears a long tail, and the limbs are but little developed. Nor is Didocus identical with the undeveloped condition of Pelobates, since both cranium and limbs of the latter are developed before the tail is absorbed. Nor is Pelobates identical with the undeveleped condition of Cultripes, since while the cranium of the latter is that of the former, the limbs and tail are still larval. The same relations exist between the other members of the family. The genus Scaphiopus is not an undeveloped form of Pelobates as to its auditory organs, for when the latter is identical with the former in this respect, it bears otherwise entirely larval characters. Nor is Spea an arrested Scaphiopus, the relation being here precisely that between Didocus and Pelobates. Spea approaches more closely an arrested Didocus in all respects, but that when the latter posesses the auditory apparatus† of the former, it is a larva in limbs and tail, and that it loses this apparatus before reaching the other characters of Spea. The relations of these genera, as compared with those of the Trachycephalus, Cystignathidæ and Bufo series, may be represented as follows: the lines represent the developmental scale of each.

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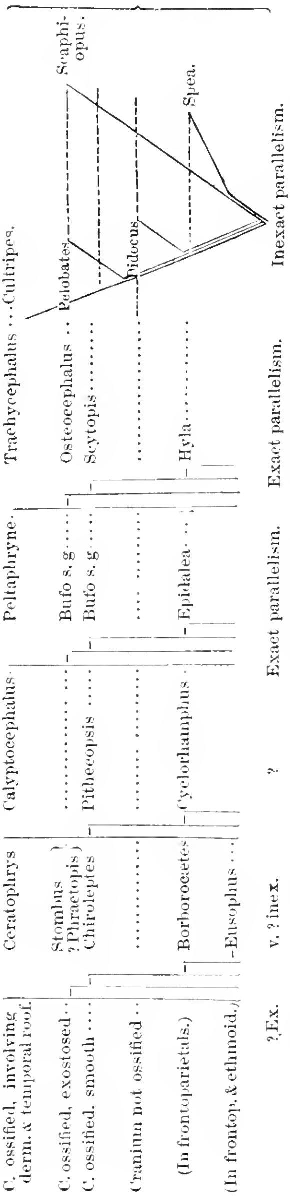
* See Journal Academy, 1866, on Arcifera.

† The possession of cavum tympani and tuba Eustachii in the undeveloped condition of this genus is only assumed from its close relation to Pelobates.

‡ According to Bruch and Tschudi in Pelobates. I have found traces of the eustachian diverticula in a tailed Pelobates fuscus, whose body measured 1 in. 4 lin., from Mus. Peabody Institute, Salem, Mass.

Relations between the terms of the different series, Heterology or Remote Parallelism.



This is an example of the simplest case of inexact parallelism, as distinguished from the exact parallelism or identity. As the fauna of the present period is but a fragment, so the simple inexact is a more frequent relation than the exact, while the more complex inexact relation is still more common. The greater the inexactitude, the more frequently do such parallels occur, till we have those of the most remote character, as, for instance, the parallelism between the different stages of the development of the mammal, in the structure of the heart and and origins of the aorta, and the existing classes of vertebrates. The relation of these facts to the origin of genera will be noted hereafter.

It will be borne in mind that in the Scaphiopodidæ the generic types are identical for a long portion of their developmental history.

2. In both Perissodactylous and Artiodactylous Mammalia, certain types develop their family character of canines at the earliest appearance of dentition, others not till a comparatively late period of life (Equus), and the extreme genera never produce them.

3. Among Cetaceans the genus Orca maintains a powerful and permanent series of teeth, which is an important generic character. In Beluga the series is shed in old age, in Globiocephalus, or the Caing whales, they are shed at middle age, while in the Balænidæ, of which the absence of teeth is an essential character, these organs are developed and absorbed *during fœtal life* (Eschricht). Though the condition of the teeth is not of systematic value in the two named intermediate genera, it is the important feature in the history of progress to such value.

4. Among the tortoises, the Testudinidæ rapidly extend the ribs into a carapace, which fits closely the marginal bones, while equally early in life the elements of the sternum unite together. This is also the case with most Emydidæ; among whose genera, however, we find the transitional scale. In Dermatemys and Batagur the carapace is very late in attaining its complete ossification, while the plastron is early finished. In Chelydra, on the other hand, while the carapace is even more slowly developed, the plastron is never free from its larval fontanelles. In the marine turtles neither plastron or carapace is ever completed, while in the Trionychidæ the marginal bones are also entirely undeveloped.

In order that this last illustration be a true one for the theory in question, as applied to the *families*, these developmental characters should be the true distinctive features of these families respectively. This, as is well known, they are not. The Cheloniidæ are characterized by the form of their anterior limbs, which is in an adapted structure, while the Testudinidæ similarly are distinguished by an extreme opposite modification of foot-structure, adapted to an extreme difference of habit. Here there is an example of the co-working of both laws. Nevertheless, we only claim at present to show the developmental relation of *genera* of the same family and the same series. This we see among the Emydidæ.

5. In the important character of the scutellation of the tarsi among the Passerine birds, the "boot" appears early in life in the highest Oscines, later in the lower, and does not appear at all in the majority. In respect to the still more important feature of the long posterior plates which appear very early in most Oscines, in the Myiadestes type* they appear late, the squamæ remaining long, while the Clamatores never develop the plates, not advancing beyond the infantile squamous stage.

6. It has been shown by Falconer that the genera of great Proboscidians form a remarkably regular and graded series, distinguished by their dentition. These are Dinotherium Kaup, Trilophodon Falc.,† Mastodon Cuv., Pentalophodon Falc., Stegodon Falc., Loxodon F. Cuv., and Elephas Linn. In the first there are but two cross crests on the third molars, and a pair of permanent mandibular tusks; in the second, three cross crests and mandibular tusks only permanent in some males; in the third, four cross crests and the mandibular tusks all deciduous; in the fourth, five cross crests on the third molar; tusks unknown. In Stegodon the tusks cease to appear, the crests of the third molar become more numerous, and embrace between them, in the bottoms of the valleys, a strong deposit of cementum. In Loxodon the crests have the whole interspaces filled with cementum, while the same thing holds in Elephas, with a greatly increased number of cross crests, which become vertical laminæ. The laminar character has become apparent from its rudimental condition in Stegodon.

Now these are stages of development, though not in a continuous, single line. The shedding of the inferior tusks takes place earlier and earlier in the genera from Dinotherium, till they never appear in Stegodon. The molar teeth, it is well known, present, as they succeed each other from back to front, a regularly increasing number of transverse crests in the same species. Thus, in Trilophodon ohioticus the first molar presents but two, while the last presents six. The last molars of other genera present a very much increased number. What is it then, but that the increased number of crests in the third molar, definitive of these genera, is an acceleration of growth; the fourth in Trilophodon is structurally third in Mastodon, and the fourth of Mastodon being third in Pentalophodon, the fourth of Pentalophodon becoming third in Stegodon, and so to the end? This is confirmed from the proven fact of the disappearance of the premolars. They are fewer in Trilophodon‡ than in

* Baird, Review Birds N. America.

† The genus Mastodon, as left by Cuvier, embraced two genera, as has been clearly shown by that excellent palæantologist, the late Dr. Falconer. He named these genera Trilophodon and Tetralophodon. It appears to us that this was unnecessary, as he was aware that Dr. Godman had named the American Mastodon Tetracaulodon from its sometimes persistent inferior tusks, a character distinguishing it from the later genera of the series, though not so trenchantly as the three crests of its third molar, as pointed out by Falconer. As this group was taken from the Cuvierian Mastodon, it should retain Godman's name, for the T. ohioticus, the T. angustidens and T. humboldii, while Cuvier's name should be preserved for the remainder, viz., M. longirostris, M. borsoni, M. arvernensis, etc., the *Tetralophodons* of Falconer.

‡ The two-crested and first three-crested molars are usually called milk molars, because early shed. As, however, they are not succeeded by any subsequent teeth, but are similar to those which lie behind them in the jaw, I cannot see why they are not true premolars. Dr. Warren, in his monograph of Mastodon ohioticus, says "This is called the third deciduous tooth, but why it is more entitled to this epithet than the two which follow it would be difficult to determine. Are not the first and second so-called permanent teeth equally deciduous, since they are shed, and leave the last permanent molar solitary?" V. p. 69. Flower says (Transac. Royal Society, 1867. 638), "In the Dugong and in the existing Elephants the successional process is limited to the incisor teeth."

Dinotherium, and soon shed; they are also early shed in Mastodon and Stegodon (insignis Falc. Caut.) and are not known to exist in the succeeding types; the acceleration of succession of teeth has caused them to be entirely omitted. The young tooth of Elephas moreover is represented by a series of independent parallel laminæ at first, which, when they unite, form a series of crests similar to the type of the genus Mastodon and others of the beginning of the series. The deposit of cementum takes place later, till the valleys are entirely filled up. Thus the relations of this part of the tooth structure in the series are also those of the successional growth of those of Elephas, or the extreme of the series.

It would be only necessary to show that two distinct conditions in any of these respects occurred among the different individuals of the same species of any of these genera, to render a hypothesis of evolution a demonstrated fact.

It must be here observed that great size indicates little or nothing as to zoological rank. It merely indicates the expenditure of a large amount of stored vegetative force in the individuals of the group, however limited, which exhibits it. The greatest species are often not far removed in affinity from the least; thus there can be but little doubt that Elephants are not far removed from the Rodents, and the Rhinoceros is near the Cony. Indeed, in the same genus the most extraordinary diversity prevails, for we have a very small Elephant of Malta, and in the Miocene of Maryland a fin-back whale not so large as the new-born young of the fin-backs now living. Hence Prof. Dana's objection* to the developmental hypothesis, based on the great size of the primal Selachians and Ganoids, has but little weight.

7. Rathke has shown that the arteria ophthalmica of the higher Ophidians is originally a branch of the arteria cerebralis anterior, and that it later forms a connection with the arteria facialis. This connection increases in strength, while the other diminishes, until finally its supply of blood is derived from the facialis instead of the cerebralis.

Rathke has also shown that the cerebral origin of this artery is continued through life in the three lowest suborders of the serpents, the Scolecophidia, Catodonta and Tortricina; also in the next succeeding group, the Peropoda.

8. In most serpents the left lung is never developed; in such the pulmonary artery instead of being totally wanting, remains as a posterior aorta bow, connected with the aorta by a ductus botalli; serpents without left lung being therefore identical in this respect with the embryonic type of those in which that lung exists.

9. Dr. Lespes states that the optic region of the brain of blind cave Coleoptera, examined by him, is similar in structure to that in the blind larvæ of Coleoptera, whose imagos possess visual organs.

† 10. Those Saurians, (Uromastix, etc.,) in which the premaxillary region is produced into a uniform cutting edge, are furnished during early stages with a series of premaxillary teeth, which become gradually fused and confluent with the alveolar margin. Hence other Acrodonts are equivalent, in this respect, to the young of Uromastix, etc. The same thing occurs among the Scaroid and Labroid fishes. In this most natural family we find the majority of generic forms provided with a normal complete dentition; in others (Chaerops, Xiphochilus, Pseudodax, etc.,) the lateral teeth are gradually and normally replaced by a more or less cutting edge of the mandible; and finally, in the Scarina and Odacina the entire mass of teeth and jaws are coalesced, forming a beak with sharp cutting edges, the single teeth being still visible in the true Scarus, while they have entirely disappeared in adult Pseudoscarus and Odax.‡ Thus in dentition the adult Scarus is identical with not fully developed Odax; Chaerops with the teeth less confluent, equals a still younger

* Manual of Geology, p.

† See under section on acceleration and retardation.

‡ Günther on Hatteria, Philosophical Transactions, 1867, II. I had already noticed the peculiar development in Uromastix, but not published it.

stage of Odax, while those with distinct teeth are the same in this point as the embryos of the highest—Odax, etc. I venture to predict that here will be found a long series of *exact parallelism*, in which the different genera, resting exclusively on these dental characters, will be found to be *identical* generically with the various stages of the successively most advanced.

11. Professor Agassiz states that the absence of ventral fins is characteristic of an embryonic condition of the Cyprinodont fishes. The genus Orestias does not progress beyond this stage in this one point. Probably the genus will be found which will only differ from Orestias in the presence of ventral fins. If so, Orestias will be identical with an imperfect stage of that genus, if, as will probably be the case, the fins appear in the latter, after other structures are fully completed.

γγ. Parallelism in Higher Groups.

It is not to be anticipated that the series of genera exhibiting exact parallelism can embrace many such terms, since comparatively few stages in the developmental condition of the same part in the highest, would bring us back to a larval condition, which, as far as we yet know, has no *exact parallel* among existing genera. But it is to be believed that the lowest terms of a number of the most nearly allied of such series, do of themselves form another series of exact parallelisms.

Thus exact parallelism between *existing* genera of mammals ceases with all characters which are larval or fœtal only prior to the assumption of the adult dentition, since among the higher mammalia at least we know of no genus which, however similar to undeveloped stages of the higher, never loses the milk dentition. It is nevertheless an important fact that, among smooth brained mammals, or many of them, but one tooth of the second series appears; and inasmuch as smooth brained forms of the higher orders have become extinct, it is not too much to anticipate that a type of permanent milk dentition will be found among the extinct forms of the same high orders.

As an example of exact parallelism in series of series, I select the following:

1. in the Batrachian family Cystignathidæ there are six groups or sets of genera. In the highest of these we have an ossified cranium and xiphisternum —i. e. in the Cystignathi; in the Pleurodemæ the cranium is not ossified, thus representing the Cystignathi while incomplete; in the Criniæ the xiphisternum is cartilaginous, as well as the fronto-parietal region, being an equivalent of a still lower stage of the Cystignathi. From this simplest type we can find a rising series by a different combination of characters; thus the Ceratophydes add an osseous cranium to the incomplete xiphisternum, while two succeeding groups diverge from each other at the start, the Pseudes loosening the outer metatarsus in their development to maturity, while the Hylodes add by degrees a cross-limb to the last phalange. The Ceratophrydes and Criniæ are stages in the development of these, but neither one of them is a step in the development of the other. They are measured by adaptive characters purely.

2. The whole suborder of the Anurous Batrachia, to which the above family belongs, the Arcifera, differs from the suborder Raniformia by a character which distinguishes a primary stage of growth of the latter from its fully developed form. That is, the Raniformia present, at one period of their development, a pair of parallel or over-lapping curved cartilages, connecting the the procoracoid and coracoid bones, which subsequently unite and become a single, slender median, scarcely visible rod, while the bones named expand and meet. The first condition is the permanent and sole systematic character of the Arcifera.*

* This may be readily understood by comparing my monograph of the Arcifera, Journ. Ac. Nat. Sci. Phil., 1866, with Duges work, or Gegenbaur & Parker's memoirs on the shoulder girdle.

Objection.—It may be objected by those who have observed some of these developmental relations, that they are exhibited by certain single structures only, and not by whole organisms. These objectors must not forget that the distinctions of those groups, which alone we have in one geological period in a relation of near affinity, exist in *single characters only;* and that it is therefore infinitely probable that the higher groups, when we come to know their representatives with the same completeness, will prove to be separated by single characters of difference also.

3. The following table is here introduced to illustrate the relations of groups higher than the preceding. This is largely measured by the circulatory system, not only as to the class relations, but also as regards orders. In its less central portions it is, however, definitive of families at times.* [The reader is here referred to the table commencing on p. 256.]

If the reader will compare the history of the development of vertebrates of any class or order, as those of Teleosts and the lizard by Lereboullet, of the snake and tortoise by Rathke and Agassiz, and of the bird and mammal by Von Baer, he will find the most complete examples of the *inexact parallelism* of the lower types with the embryonic stages of the higher. A few points are selected as examples, from the histories included in a few of the columns of the table, and given at its end.

Similar parallels may be found to exist in the most beautiful manner between the adult anatomy and structure of the urogenital apparatus within each class of the series taken separately, as indicating ordinal relationship. This department is, however, omitted for the present.

As an example of the homologies derivable from the circulatory system, and of the use of the preceding table, I give the following relations between the types of the origins of the aorta.†

The single ventricle of Teleostei is no doubt homologous with that of Lepidosteus, and that of Lepidosiren. The *arteria vesicæ natatoriæ*, which is the homologue of the *A. pulmonalis* of air breathers, issues in Lepidosteus from the last *vena branchialis*, thus receiving aërated blood from the gills In Lepidosiren it issues from the point of junction of two gilless and two gill-bearing *venæ branchiales*, thus receiving mixed blue and red blood, or blue blood altogether, when the branchiæ are not in functional activity. In Proteus it issues from the last vena branchialis, where it receives the *ductus botalli* of the preceding vein, which, when the gill is inactive, becomes a gilless aorta-bow, which brings it only carbonized blood, which it readily aërates in the swim bladder, now become a lung. The ventricle is homologous with the preceding. In Salamanders, where the substitution of the accessory gill arches by the *ductus botalli*, converts the *arteriæ* and *venæ branchiales* into "aorta-bows," the *A. pulmonalis* is given off from the posterior bow, and receives henceforth mixed blood. In the Anura the origin is the same but nearer the heart. In Gymnophidia it approaches the heart so far as to issue from the extremity of the bulbus arteriosus, which is now divided by an incomplete septum, one half conveying blood to the *aorta roots*, and the other to the *A. pulmonalis*. This septum was already preceded by a longitudinal valve with free margin in the Anura! As if to meet the coming event, a trace of ventricular septum appears at the apex within. There can now be no question of the homology of the ventricles of the gar, and of the Cæcilia. But we have next the true Reptilia. The Bulbus arteriosus is split externally, as it already was internally, but it is first represented in most Tortoises by an adherent portion, one-

* This sketch is not nearly complete, but is published in hopes of its being useful to students. It is compiled from the works of Meckel, Rathke, Barkow, Müller, Hyrtl, Brücke, Stannius and others, in connection with numerous dissections.

† Professor Agassiz (Contrib. Nat. Hist. U. S., I 285) states that the ventricle of the Testudinata "is not any more identical with the one ventricle of fishes, than with the two ventricles of warm blooded vertebrata; for in fishes we find only one vessel, the aorta, arising from it, while in Turtles both the aorta and arteria pulmonalis start together from it." We think this statement, which, if true, is destructive to the asserted homologies of the circulatory system, cannot be substantiated, for the reasons above given.

half being the now, to this point, independent *arteria pulmonalis* and the other the nearly split aorta roots. There can, I think, be little question of the exactitude of the homology throughout.

It is no less certain that the Salamander* fulfils in its development the different stages to its permanent one, and is *identical* in each stage. in *respect to this point*, with the orders it represents at the time. This is true even of the long period during which it bears the long branchial appendages and contained arteries and veins which are not found in fishes; it is then like the Protopterus, which has hyoid venous arches and appendages of those arches at the same time. The Tortoise † and Tropidonotus, ‡ are also identical in their successive stages with the types already enumerated, the external or appendicular branchial vessels being omitted as belonging to the special serial development of the line of air-breathing Anallantoidans. The division of the bulbus arteriosus into three instead of two may indicate a case of *inexact parallelism*, but on the other hand it may be that the pulmonary partition is completed a little before the aorta-root partition, thus passing through the Batrachian permanent type. For explanations of inexactitude see under Part II. No doubt the Batrachian type of bulbus arteriosus is passed by many serpents less extreme and specialized than the Tropidonotus.

The aortic and pulmonary divisions of the bulbus in the Cæcilia are not laterally placed, but one is dorsal and the other ventral, the one passing a little spirally to the right of the other. So the pulmonary division of the bulbus turns over to the right in the Anura. When the septum of the true reptiles appears it rises on the anterior wall of the ventricle till it is seen in Eunectes to meet the partition between the *arteria pulmonalis* and *aorta-roots*, and we have at once the right and left ventricles of the bird and mammal structurally and functionally. Thus are the two ventricles of man the same as the one ventricle of the fish, merely divided by a septum.§

In the fissure of the aortic bulbus in the reptiles a spiral turn is again given, and in Testudo the one aorta-root issues behind the other. In the Crocodile the turn is still greater, and the right aorta-root issues to the left of the left root, and vice versa. In the birds we have lost the left root, and parallelism ceases with this change. In the mammalia the right root turns to the left, so that in the comparison of these classes the rule of Von Baer above quoted is true; no mammal at present known is identical in a fœtal stage with any fully grown bird, but with a fœtus of the same, up to a certain point. But for both classes the parallelism of those below them holds true.

But it is with the exact parallelism or identity of genera that we have to do in the present essay. That being established, the inexact parallelism between the modern representatives of higher groups, follows by a process of reduction.

δ. *The extent of parallelism.*

Prof. De Serres and others have stated it as their belief that the lower "branches" of the animal kingdom are identical with the undeveloped forms of the higher; i. e. that the mollusc and articulate are not merely parallel with, but the same as the lower conditions of the vertebrate. The works of various embryologists as Von Baer and Lereboullet, have shown this statement to be erroneous "and founded on false and deceptive appearances." The embryos of the four great branches of the animal kingdom appear to be distinct in essential characters, from their first appearance. But Lereboullet, who, in his prize essay, has compared with care the development of the trout, pike,

* Amblystoma. † Agassiz. ‡ Rathke.

§ Agassiz, l. c., denies the homology of the ventricles of the turtle and mammal, but it appears to me erroneously. He says: "The fact that the great blood vessels (aorta and art. pulmonalis) start together from the cavum venosum seems to prove that the two cavities in the heart of turtles, which are by no means very marked, do not correspond to the two ventricles in mammalia and birds."

	Heart sac.	*Auricles.*	*Ventricles.*	*Atrio ventric. valves.*	*Ventr. aorto-pulm., or aorto-bulbus valves.*	*Auriculo-sinous valves.*
Leptocardii	None	None	*One*, elongate	None	None	None.
Dermopteri	Pres'nt, att. to heart at *sinus & bran. trunk.*	Present. Septum none. *Externally one.*	One, oval	*Orifice* 1; two valv's, membranous; no columnæ or chordæ.	*A.* To trunc's branch'l. Two semilunar.	Double.
Hyperotreti	Open into abd'm. cav.	Poster. to ventricle.				
Hyperoarti	Clos'd in petromyzon					
Elasmobranchii	Conn. by tube w. abdom. cav.		One trans.; (2) musc. reticul.; no column. carneæ.	" " two valves	*B.* To bulb's arterio's.	" with threads.
Plagiostomi	a. Bifurcate.					
Holocephali	b. Simple.					
Teleostei Apodes	Closed; con. w. heart by bands in muræna and some gadidæ.	Opposite ventr	One, pyramid'l; (2) "	" " two valves	Two (4 in Orthagoriscus).	" (Four in Orthagoriscus); threads not constant.
Eventognathi		Opposite ventr.				
Heterosomata		Opposite ventr.				
In general		Dorsal anter.				
Ganoidei		Dors. ant. No sept.	(2) "			
Chondrostei	Conn. w. abd. by simple duct.		" with vasc'lar elevat's dors'ly & con. by vessels to pericard'm.	" " two valves; w. chordæ tendineæ.		One, annular, split, each half w. pockets,
Holostei			One, pyriform, (3) w. trabiculæ carneæ.			Double.
Lepidosteus				" " ⅔ the apert'e bound'd by one valve.	None	
Polypterus	Only a deep concav. towards abd. cav.					
Dipnoi	Closed	Dors. ant. An incomplete septum.	One, pyriform	" " ; *one valve* bounded by chordæ cartilagineæ.	No semilunar	None.
Batrachia Urodela	Closed					
Proteida		A complete septum.		*Two orifices.*		
Trachystomata	Clos'd; *att by infer. 3d of post face.*			" "		
Trematodera	Closed; att. to apex in Amphiuma.	A complete septum.		" "		
Myctodera		A complete septum.				
Anura		A complete septum.	No rudiment'y sept. 1 & 2 " 3 & (4) a rudiment. sept. fr. apex.	" " approximate, small.	One at orifice of e. of the two primary div. of bulbus.	None in Pipa.
Gymnophiona						
Reptilia	Closed	A compl. sept. *Externally two.*		*Two orifices.*	*Three semil.* at ostium bulbi. ? valv. at m'th of bulb.	
Lacertilia						Two.
Amphisbænia						
Ophidia			Walls not thick; very coarse network in sin. arteriosus.	One. One	aor. 2 semi. 2 semi. p. 2 semil.	Two, semilun.

Testudinata	Closed; att. by infer. 3d of post. face.	A complete sept. ..	" 1 & 2 " 3, 4,(5) walls very thick & spongy; ossiculum on anter. end, complete side of septum.	Two; the right rudimentary.	One.	2 semil.; 2 semil.; inn'r of both on ossicu.	2; inner on ossiculum.	Two semil.
Crocodilia	" " "	A complete sept. ..	*Two*, sept. compl'te; 2 & 4 " occasion'l perforations near apex.	Two; the right muscular.	One (? or 2).	2 semi.; 2 semi.	2 semil.	"
Aves	Closed	A compl. sept. Externally slightly separated fr. ventricles.	1 " 2, musc. trebeculæ & column. carn'æ; septum convex into right ventr.	Two; right larg'r, musc.	Two.	3 semil.	3 "	" inferior = valvula eustachii.
Cursores Apteryx	....	....	....	Chordæ tendineæ sinistræ.				
Mammalia	Closed	A complete septum.	1 & 2 " walls more compact.	3 (" tricuspid ").	3 (" mitral").	" "	3 "	One = v. eustachii; rudimentary.
Implacentialia	....	Right, small	....	All membranous & bound by chordæ tendineæ; in monotremata; two in mitral, w. are att. to columnæ carneæ.				
Monotremata ..	....	....	....					
Marsupialia	....	No fossa ovalis on septum.						
Placentialia								
Halicore	....	....	Separated for some length.					

	Post-ventricular cavity.	*Arteriæ branchiales.*	*Venæ branchiales.*	*Arteria pulmonalis.*	*Vena pulmonalis. At first v. vesicæ pneum*	*Art. subclaviæ.*
Leptocardii	I. Series of lateral alternating bulbilli.	One *from* each *bulbillus.*	*Enter aorta direct;* All separate.	None (no swim-	bladder). None.	None.
Dermopteri	II. Truncus branchialis communis.	[A pair of ant. or false aor. bows; rudimentary in Hyperotreti.] *Fr. truncus;* 7 usually anter. somet. united, = bifurca of truncus.	? united.	"................	....	"
Elasmobranchii	III. Bulbus arteriosus w. musc. coat & 2 or more rows valves.	*Fr. truncus.* 5; fr. bulbus: 2 ant. united.	Anterior united ...	"		
Plagiostomi.						
Squali	....	Three post. sepa'te.				
Rajæ	....	Three post. united.	....	....	....	From origin of aort.
Pristes	....	Three post. united.				
Holocephali.						

	Post-ventricular cavity.	*Arteriæ branchiales.*	*Venæ branchiales.*	*Arteria pulmonalis.*	*Vena pulmonalis. At first v. vesicæ pneum.*	*Art. subclavia.*
Teleostei ...	IV. Bulbus arter. without musc. walls, no valves. (exc. Butyrinus.)	*Fr. truncus* which is fr. bulbus; 4 on each side, (anter. wanting).	*Enter aort.* by a. roots, *i. e.*, by poster. trunks of circulus cephalicus, or direct when poster. to completion of circulus.	? Empties into portal, hepatic or cardinal vein.	Into vena hemiazygia or from vertebralis posterior; often subdivides into rete, and unites.	Origin often unsymmetri'l. Comm. trunk of anter. venæ branchiales Esox.
Apodes Murænophis ...		a. Two ant. sepa'te. b. Two ant. united.				
Nematogn. Saccobranchus ...	...	1. All to gills. * Post. sending art. to air sac, = branch. operc.				From origin of aort.; Perca.
Class in general ...	...	** Post. not send'ng art. to air sac, = bran. operc.	...	...	Into v. portæ in Lota.	Fr. each aorta root; Gadus.
Ap. Symbranchus Monopterus ...	...	2 4th no gill, ∴ = aor. bow.	...	...	...	From origin of aorta, then dividing into 3; one branchialis, one *lateralis!* one dorsal. ascend.
Amphipnous ...	...	Five art. bran. ant. to air sac. 1st & 4th no gills; vein from air sac to 4th.				
Ganoidea ...	V. Bulbus arter. w. musc. walls and 3 or very many rows valv.	*Fr. truncus*, fr. bulbus; 5 on e. side; ant. is an opercular pseudo-branch'l and revehent art.	*Enter aorta* direct.			
Chondrostei.		1. Rising from 2d art. branch.				
Spatularia ...	...	a. 1st true branch'l to 2d gill; 2d and 3d united.				
Accipenser ...	...	b. 1st true br. art. to 1st gill.				
Holostei ...	...	2. Rising fr. & = ant. fork of truncus; 1st true art. br. to 1st gill.				
Lepidosteus ...	...	...	...	...	...	Very large; fr. aort., poster. to entrance of 3d vena. branch. communis.
Polypterus ...	...	...	...	From last vena branchialis.	*Enters hepatic vein.*	
Amia ...	...	Four on e. side fr. truncus, 2 ant. unit'd.	...	? Empt. into vena cava ascend.	" vena cava ascendens.	
Dipnoi ...	VI. Bulb. arter. spiral. w. two elongate spir. valves.	*Fr. 2 primary heads of bulbus*; 5 on e. side; 1st rising fr. 2d; 2d & 3 gilless; 5th to 2 gills.	*Enter two aorta-roots*: two become parts of aorta-bows.	From confluence of v. branchiales & aorta bows.	*Enters auricu'la sinistra*, pass's vena cava & sinus & has valv. tuberc. at ostium.	
Protopterus ...	...	a. Trunc. to ext'l gills.				
Lepidosiren ...	...	b. No " " "				

Batrachia .... Urodela.	VII. Bulb. not muscular; a longitud. v.	....	....	....	"	
Proteida	Bulb. narrow at beginning.	Prim'y div. of bulb. =2 trunc. br. comm.: 3 Art. br. on each side, 2 post. united first.	Are both ven. branch and aorta-bows, from existence of 3 duct. botalli.	From poster. vena branch.	....	From aorta.
Trachystomata ·	Bulb. twisted; one longit. elevat. (= septum) w. six grooves corr. to art. branch.	a, b. *From bulbus*; 3 on each side.	No ductus botalli.	" " "		
		Become *aorta bows* from want of gills.		Fr. poster. aort. bow.		
Trematodera	....	Four; ant. & post. conn. by duct's botalli; 2 median = aorta root.				
Myctodera	....	Four; ant. & post. conn. by duct's botalli; 2 median = aorta root and with one ostium into bulbus art.		" " " giving branch's to œsoph and pericardium.	....	" "
Anura	Contain. longit. septum w. a free edge: each half prolonged into 1 primary div. of bulbus.	Three; no ductus botalli; median = aort. root.		Fr. poster. aort. bow sends off ramus cutaneus in front of shoulder to back.		
Gymnophiona	Elongate; div. anterior. into dorsal & ventral cham.; valves at origin.	One; by obliteration of 1st and last, *aorta roots* only remain.		Fr. dorsal chamber of *bulbus arteriosus*.		
Reptilia	VIII. No proper bulbus; the aorta roots and pulm. art. adherent.			From cavum venosum =(dextrum) of ventricle.		
Lacertilia in gen.	....	Two aort. bows, fr comm. ostium fr. cavum arteriosum (sinistrum).		....	"	From trun. subclav. comm.; fr. right aorta root.
Varanidæ and Tupinambis	....	One aorta bow, =aorta root. " "				
Amphisbænia	....	*One* " " " "				
Ophidia	....	" " "				
Testudinata	Aorta roots and art. pulm. adherent and surr. by ring of musc. tissue at origins.			....	"	Each fr. innommin., fr. trun.innom.comm. from right aorta root.
Crocodilia	Aorta roots and pulm. art. adherent; right aorta root from left ventr., left from right, commun. by a foramen above valves.			From right ventricle; attached.	"	Dextra fr. right aort. root; sinist. fr. innom.
Aves	IX. Right aorta root (fr. left ventr.) only =aorta.			Do. Free.	"	Sinistra very large; given from aorta immediately; first as innominata.
Mammalia	X. Right aorta root (*i. e.*, aorta) turning over the left bronchus to the left side.			Do. "	"	Dextra issues later; sometimes an innominata.

	Carotides.	*Cerebrales.*	*Ophthalmicæ.*	*Vertebrales.*	*Intercostales.*
Leptocardii.					
Dermopteri					
Hyperotreti ...	1. Each carot. communis a continuation of a vessel connecting venæ branch. parallel to aorta. Divide to *c. ext.* and *int.* behind skull; *intern.* unite at base of cranium and receive vertebralis.	Median from conjunction of carot. intern.	....	Median, a continuation of aorta.	
Hyperoarti	2. Carot. communis from anter. venabranchialis. Carot. intern. do not unite.				
Elasmobranchii	3. No c. communis; posterior from 1st vena branch. or from united anterior ven. branchiales; united beneath cranium.	....	....	....	From aorta direct.
Plagiostomi ...	(a.) Anter. carot. from pseudobranchia, *i. e.*, vena branch. prima.	....	Fr. pseudo-branchiæ		
Holocephali ...	b. Ant. ("poster.?") from ven. branch. secunda.	....	Fr. carotis anterior.		
Teleostei	4. C. commun. from circulus cephalicus.	....	Fr. pseudo-branch., ends in "glandula choroidalis."	....	Often break into retes.
Ganoidei	....	....	Fr. pseudo-branch.		
Chondrostei ...	As in 3 (a).				
Holostei.					
Lepidosteus .	5. Anter. carot. from aorta, anter. to entr. of 3d pair of v. branchiales; poster. carot. sending no branch to brain.	From near origin of aorta.	Fr. pseudo-branch.		
Dipnoi	As in 3 (b).	....	Fr. carotis anterior.		
Batrachia.					
Proteida	As in 3: (c), the ? anter. ("post.") carot. from aorta bow.				
Trachystomata					
Trematodera ..	6.(a) Carotis comm. from anter. aorta-bow. No glandula carotica.				
Myctodera	6 (b). A glandula carotica.	....	From aorta-root (most anteriorly).	....	In pairs from aorta.
Anura	6 (b). Carot. extern. cont. 1st as max. intern. and then opthalm.	....	From carot. extern.	....	Small; from an "a. supravertebralis" run'g. ab. diapoph. on each side, ?homolog. w. intercostal. prim.?
Gymnophiona .	7. Carotis commun. from anter. curve of each aorta root.				
Reptilia	A. Carotis poster. connected w. its fellow by ramus communicans behind foramen magn.	B. Continuation of carotis interna. Circulus willisii compl'te	From A. facialis (= carot. ext.) more or less connected with cerebr. anter.		

Ophidia	8. Both. carot. commun. from right aorta-root direct. (a). Entirely separate. (b). Running together after issuing from a short tr. carot. impar. (c). Left carot. comm. rudimentary. (d). " " " absent.	....	....	One from trunc. arter. dexter.; divides; each half running beneath diapophyses & entering ramus com. of carotis internal; through this to basilaris.	Fr. trunc. art. dexter., fr. comm. truncs fr. aorta.
Peropoda, Angiostomata	....	....	Fr. cerebralis anter.	In Rhinophis, strong, like a cont. of aorta.	
Amphisbænia	7. Each carot. comm. from anter. part of each aorta-root.		From?		
Lacertilia	....	....	Fr. art. facialis....	Two from axillaris; each entering spinal canal and forming a supraspin. thro' those to basilaris.	Fr. sublaviæ, trunc. arterios. dexter, and aorta.
Varanidæ and Tupinambis	As in 7.				
In general	9. Each carot. comm. a continuation of cardiac extrem. of anter. aorta bow.				
Testudinata	10. Each c. c. from innominata; fr. common innom.; from right aorta root.	....	Fr. cerebralis anter.	" " " also connect w. cervicalis descend. from carot. extern.	In body and tail fr. an intercostal, prima continued fr. subcl. to iliaca, the "intern. recurrens." In neck from ram. comm. fr. carot. ext. to subclav.
Crocodilia	11 (a). Car. comm. fr. truncus carot. impar, w. is from left innom.; or (b) c. com., each from an innom.; all from right aorta-root, or as in 10.				
Aves	B. *No occip. union of carotides posteriores*: one or both c. comm. run on sides of neck.	Fr. a union or communication of carot. int. w.= ramus com. of cerebralis anter. of mamm.; circ. willisii is abbreviated anteriorly. Cer. anter. goes to orbit or olfactory reg. Poster. to basilaris & spinalis anter.	External branch of carotis internus.	B. *Traverses cervical canal.* 1. Not forming basilaris; conn. w. occipitalis. From truncus or carot. communis of its side.	Usually from aorta.
Insessores: Passeres, Zygodactyli 3/4, Syndactyli 1/2	(a). Car. comm. fr. tr. carotic. impar. fr. left innom. [vid. on Pitta sp. Tidjschr, Neederl. Ind.]				
Synactyli, Zygodactyli cuculus and in general, Cursores, exc. Rhea, Natatores	(b). Carot. comm. from each innom. from aorta.	....	....	....	In Gallus, a few fr. intercost. prima; in Ciconia last from Epigastr., rest fr. prima.
Natatores Podiceps	As (a)........	....	....	....	In Anas 5 or 6 from intercost. prima, 3 or 4 fr. vess. connect. interc. prima w. aorta.

	Carotides.	*Cerebrales.*	*Ophthalmicæ.*	*Vertebrales.*	*Intercostales.*
Cursores Botaurus	As in 11 (b)!				
" Phœnicopterus	(c). Carot. comm. from right innom. from aorta.				
Mammalia	....	Via canal carot., or foramen jugulare.			
Implacentialia					
Monotremata, Phascolomys & Phascolarctus	d. One car. comm. fr. innom. dextra fr. aorta; one from aorta direct.	Ramus communic. betw. cerebr. anter. C. willisii alw'ys pres'nt.		3. Forming basilar.	
Marsupialia	c. Both c. c. fr. innom. dextr.; fr. aorta.	Sonet. ramus comm. is between art. corporis callosi.			
Placent. Rodentia	e. " " " " " except Muridæ, Cricetus, Dipus Meriones, which exhibit d.	Fr. carot. ext. via a. opthalmic and foram. opt. in some Caviidæ; via max. intern. and foram. lac. anter. Hystrix.	Sciurus=intern. br. of ant. cerebr. (br. ext. leaves cran. and joins max. interna). Arctomys same, without extern. branch.	In Mustela fr. tr. communis vertebr. fr. aorta.	In Mustela, anterior fr. tr. com. verteb.
Proboscidia	f. From truncus car. impar.; fr. aorta direct; Elephas.				
Artiodactyla	g. From truncus car. impar.; from right innom. Sus.	From carot. ext. via max. intern. in Ovis.	Sus; from max. int. =carot. ext.	2. Connected with occipitalis; w. basilar by small branches.	
Perissodactyla	h. Each c. com. from right innom.; from innom. communis.				
Equus	i. From tr. carot. impar.; from r. innom.; from innom. communis.	....	....	As in 1	
Cetacea, Halicore	As e.	....	....	As in 3	
Cetacea, Phocæna	As i.				
Cetacea, Delphinidæ	k. No carot. comm. Carot. intern. and ext. fr. innom.	....	....	4. Confluent w. occipital. and cervic. ascend. = "cervico-occip."	5. Anter. fr. mammar. intern.
Carnivora	As in e, except Phocidæ=d., also Brachypus, Dasypus and Cyclothorus.	....	....	As in 2 in Canis, Mustela.	
Edentata					
Insectivora, Sorex	As in e.	& in some rodents, enter'g via stapes!!			
Insectivora, Talpa	As in l.				
Insectivora, Erinaceus	As in d.				
Cheiroptera	l. C. comm. fr. each innom.; fr. aorta.				
Quadrumana	As in d.				
Homo	....	....	....	....	1st fr. subcl., rest of dors. div. from aorta.

	A. cœliaca.	*A. mesenterica.*	*A. iliaca.*	*Sinus venosus.*	*Venæ anonymæ.*	*v. Hemiazygeæ or Vertebrales poster.*
Leptocardi Dermopteri	From aorta.			a. Present; contractile.		I. Supravertebral. (a continuation of caudalis):
Hyperoptreti					I. One on left side	On left side only.
Hyperoarti					II. Two, called "Trunci transversi." Receive subclaviæ, vertebrales and hemiazygeæ.	On both; equally large. (In Petromyzon *conn. w. subvert.* sac.)
Elasmobranchii	" Includes Mesenterica anterior.	A posterior only.		Present		II. Subvertebral. a. Emptying into anonyma.
Plagiostomi Squali	In Lamna sp. developes retes mirabiles near diaphragm.					* Of equal size. Receive renales revehentes.
Pristes Rajæ	[Mesent. ant. separate					Conn. w. a subvert. sac.
Holocephali Teleostei	[In Thynnus a subhepatic rete. [In Gadus g. from aorta root.			Present		** The dexter larger.
Plectognathi						* Of equal size (Diodon).
Ganoidei Chondrostei						* Of equal size; breaking into spongy masses or retes in Accipenser.
Holostei Dipnoi				Present.		
Batrachia				"		
Proteida	" Gastrica separate from aorta.	Many, small.	Symmetrical.			
Trachystomata Trematodera Myctodera	" Gastrica indepen.	Two, anter. & post.	Give femoralis and epigastrica.			Do not receive renal. revehs.
Anura	From left a. root, including both mesenteries.		Rise at mid. of coccyx			aa. Emptying into iliaca. Two, equal.
Gymnophiona Reptilia				Present.		

	A. cœliaca.	*A. mesenterica.*	*A. iliaca.*	*Sinus venosus.*	*Venal anonymæ.*	*v. Hemiazygeæ or Vertebrales poster.*
Ophidia ...	" Four gastricæ.	" " "	...	Continuation of anonyma dextra and v. cava inf.	An. sinistra the continuation of jugularis only.	a. Emptying into Anonyma. One median.
Amphisbænia Lacertilia. (Psammosaurus	From aorta.)	United, fr. left a. rt.				
Testudinata ...	A gastroepiploica instead.	One, fr. left a. root.	Hypogastric & cruralis separate.	a. Present...	...	III. Above heads of ribs conn. iliaca and anonymæ.
Crocodilia ...	One, incl. gastr. and mesenterica; fr. left aorta root.	...	...	?...	...	II.?
Aves ...	" Excl. mesent.; fr. abdom. aorta.	Super. fr. aorta; inf. fr. caudalis s. sacra-media.	1. *None;* cruralis & hyp'g. separate; latter fr. caud. s. sacra med., not giving ischiadica. w. rises from aorta & is larger th cruralis.	aa. Absent...	Coronaria enters an. sinistr. anonym. from union of vertebrales first, then jugularis, then subclavia.	III. a. Each unites w. ant. verteb. Comm. trunk then ent. anonyma.
Apteryx ...	" Fr. ab. diaphr'm.	Sup. fr. ab. diaphr.				
Mammalia ...	One fr. aorta.	Independent...	Cruralis and hypog. mostly separate.	aa ...	...	(II.) aa Enter v. cava descend. or anter., or the two anonym.
Implacentialia ...	...	Infer. wanting. ...	Ischiadicæ fr. aorta [(larger than cruralis) =hypog. of Meckel?]	...	"...	"
Monotremata ...						
Marsupialia ...						" 1. Two, equal.
Placentialia ...	...	Infer. present...	Ischiad. fr. hypogastr., *exc.?*			
Rodentia ...	...	Super. wanting in Cavia.				" Except?
Proboscidia ...	...	...	...	...	Elephas ...	2. One, or dextra much larger.
Perissodactyla ...	...	...	...	...	III. An. sinist. enters dextra (coronaria ent. comm. tr.) Conn. by a cross trunk in Lepus.	"
Solidungula						"
Cetacea ...	...	...	Wanting in cruralis. Hyp'g. ending in retes in Manatus.	...	...	IV. a. Run in spinal canal; emerge, unite and enter anon. dext. II.
Carnivora ...	...	...	...	...	...	
Edentata						
Insectivora ...	...	Talpa, super. emptying in coeliaca.	...	...	Erinaceus & Sorex as II.	" In Talpa, 2, equal; one entering right atrium.
Cheiroptera ...	...	Vespertilio, super. emptying in coeliaca.	...	...	Same as in II ...	" The right much larger, empt. into v. cav. desc.
Quadrumana ...	...	...	2. *Present.*			

	Vena caudalis.	(*V. vertebralis et*) *V. Jugularis* (*extern.*)	*V. cava ascendens.*	*V. iliaca.*	*V. portæ.*	*V. hepaticæ.*
Leptocardii	....	....	....	....	Contractile rythmically.	
Dermopteri	A. Single .... a. Prolonged directly into Hemiazygeæ.	A. *Does not take blood from brain.* Single (enters sinus venosus); on l'ft side.	None	....	Fr. aliment. canal and organs.	I. Two or three; emp. into sinus venosus.
Hyperotreti	....	(a). Verteb. sinister only (fr. skull).	....	....	(a). Contr. rythm'y. Receives veins of abd. wall. Has a sac-like expansion.	
Hyperoarti	....	(b). Two vertebral (from skull), mostly receive subclavia.	....	....	(b). Not contractile.	
Elasmobranchii	....	I. Double; one each side. Verteb. take blood from skull.	"	....		
Plagiostomi	Common intercost. trunks sub-divided in kidneys.	....	....	....	Concealed in margin of spiral valve.	
Rajæ .... Holocephali	....	....	....	....	Finally single.	Exhibit sinuses.
Teleostei	b. Continued as renalis advehens; as renalis, receives com. trunks of 2 or 4 intercostals.	I. or single (entering sin.) in Cottus, Thynnus; often dilate into sinuses.	" [present in Perca, from spermatica and pneumatica; does not ramify in liver.]		Often rec. veins of walls of abdomen (homolog. of epigastrica). Often tr. to liver are very numerous, esp. Eventognathi.	II. Mostly one; often two; rarely three.
Ganoidea Chondrostei	....	....	None.			
Polyodon	....	....	....	....	One trunk.	
Accipenser	....	....	....	....	....	One.
Holostei.						
Dipnoi	Divides to join renalis advehens.					
Batrachia	....	B. *Takes blood fr. brain.*	A. Present; formed fr. renal. revehentes. *Passes through liver.*	A. *Is a renal. adveh.*	From a median abdominalis anter., or epigastrica.	a. Empty into v. cava ascend.
Trachystomata						
Proteida						
Myctodera	c. Forks, each fork uniting w. cruralis.	....	....	1 a. From fork of caudalis & cruralis.		
Anura	None; crural.-renalis adv.	....	....	a. Forks of caudal. =a transv. anastomosis.	An origin fr. each iliaca.	
Gymnophiona						
Reptilia						

	Vena caudalis.	(*V. vertebralis et*) *V. Jugularis* (*extern.*)	*V. cava ascendens.*	*V. iliaca.*	*V. portæ.*	*V. hepaticæ.*
Ophidia	....	(I.) Dexter only into anonyma.	....	From fork of caud. (=?hypogas.) only on left; on right from caudalis and abdom. impar.	Is continuation of v. abdominalis w. rec. v. of aliment. canal & accom. organs; contains a long spiral valve; originates fr. iliaca dextra only.	
Amphsbiænia. Lacertilia	....	....	....	....	An origin fr. each iliaca.	
Testudinata	B. Double; ab. diapophyses.	Fr. cranial sinuses.	....	Fr. caud. (*hypogas.?*) and cruralis.	Three; 1st from two symmet. v. abd. ant., 2 fr. do. abd. post., 3d fr. v. tract. intestinal.	b. Empty into atrium dextrum.
Crocodilia	A. Single; hypaxonic.	....	Formed from renal. revehs. and branches of iliacæ.	AA. *Is not renalis adv.* 1. Sends off large ren. adv., takes up ren. rev. [Previously conn. by anast.] continued as abd. anter.	Three; an abd. fr. each side fr. iliaca, & v. of aliment. canal & organs.	a.
Aves	Two, unite and continue into V. portæ.	A. Do not receive bl. fr. brain, or a small branch only. Not near course of carotids; an anastomosis nr. head: ∴ right is larger, or alone (as in Picidæ sp.) Subst. by verteb. Run in cervic. canal.	A. Fr. iliacæ; receiv's abdom. ant. after hepaticæ.	2. Fr. hypogas. and crur. [hypogas. a continuation of lat. fk. of common caudalis; as such perforates kidney.]	Comm. trunk from united caud., taking up v. tractus intest.; [∴ =mesenterica.] or former [1] is a right v. port., the latter one or more v. p. sinistræ.	a. Usually 2, dext. & sinist. in liver.
Apteryx	....	....	....	Not imb. in kidney.		
Mammalia. Implacentialia. Placentialia.	Ent. v. cava ascend.	B. Take blood from brain; verteb. small, In cervic. canal.	B. Through groove of liver only.	2. No part. of hypogas. passes thr. kidn.	From splenic and sup. mesenter. only.	a.
Rodentia and Proboscidia.						
Artiodactyla	....	....	....	....	Semilunar valves in Bos.	
Perissodactyla	....	....	....	....	Semilunar valves in Equus.	
Cetacea.	In many into right iliaca.	....	With expansions in most divers.			
Carnivora	....	....	In Phoca enclosed by contractile muscular ring at diaph'm.			
Edentata and Insectivora.						
Cheiroptera.						
Quadrumana	....	C. Take no blood fr. brain; jugular. intern. do this.				

and perch of the Teleosts, with that of a Lacerta among reptiles, has failed to point out characters by which the embryos of the two vertebrate classes essentially differ, for a considerable period. It is true, that as each and all of the species belong to widely different generic series, parallelism is of the kind to be called *inexact* or *remote*. But enough is known of embryology and palæontology to render it extremely probable that the historic predecessors of the types whose embryology Lereboullet studied, formed a series of parallels of the kind termed in this essay *exact*.

Lereboullet states that a certain difference exists between the eggs of the fishes and those of the Lacerta. This is for us merely stating that the parents of the embryos differ, a fact which no one will contest. The same may be said of the elevated or depressed character of the surface of the vitellus on which the embryo reposes.

Secondly, after the appearance of the embryo the Lacerta is furnished with the amnios and allantois, the Teliost not. This is certainly neither a generic, ordinal nor class character of the adult, for it is but temporary; therefore in generic, ordinal and class characters the embryos of the Teliost and Reptile are still identical. It is a physiological character and not morphological, and therefore far the less likely to be a permanent one, even in embryos, under changed circumstances. The female of one of the species of Trachycephalus inverts the skin of the back at one season of the year to receive her eggs, because she cannot lay them in the water; the other species of the genus do not. The next genus in direct morphological line possesses a single species whose female does the same for the same reason; but the relations of these species and genera are zoologically the same as though this modification did not occur. Many such instances will occur to many naturalists. It is not pretended that they are as important as the presence of the allantois; but they constitute a character no doubt similar in kind, and entirely at the service of the needs of the great system of morphological succession. The same may be said of the vascular area of the Reptile.

Lereboullet concludes his summary of the differences between the Teliost and Reptile, up to the period of completion of the heart, by saying "It is easy to perceive that all these differences, however important they may appear, are constituted by the accessory organs of the embryo, and do not modify the development of the latter, which progresses in reality exactly as in the fishes." He says the same previously, as to the relation of the same to the bird and mammal.

We have then in the embryos of the lower vertebrates at a certain time in the history of each, an "*exact parallelism*" or *identity* with the embryonic condition of the type which progresses to the next degree beyond it, and of all the other types which progress successively to more distant extremes.

We have, however, so far, every reason to suppose that the embryos of the other branches of animals never present an exact parallelism with those of the vertebrata.

The embryo of the fish and that of the reptile and mammal may be said to be generically if not specifically identical up to the point where preparation for the aërial respiration of the latter appears. They each take different lines at this point. The fish diverges from the course of the reptile and proceeds to a different goal; the shark does the same, but proceeds a shorter distance, while the Dermopter scarcely leaves the point of departure. No doubt there have been types which never left this point, and *whose plan or circulatory system* is identical with that of the embryo Reptile and Mammal. *Such a type was only generically different from the reptile or mammal which had only taken the succeeding step*, provided other structures were not super-added.

By comparing the development of types of different classes in certain features which are only ordinal or generic in meaning, very erroneous conclusions may be reached by the inexact student, as to the want of parallelism of classes to each other. Thus Rathke says of the development of the eye of the Tropidonotus at a certain period, that it is far in advance of that of the mammal at the same stage. Here, says the objector, is a case where their parallelisms do not coincide; the mammal is really similar to a younger stage of the Reptile.

But, in fact, the size of the eye is but a generic or family character; if the development of the lemur had been compared with the snake, the mammal would have been found to be in advance; if the mole, much farther behind. If the snake selected were the purblind Atractaspis, almost any mammal would have been in advance; if, on the other hand, the great eyed Dipsas, but few mammalia would have been parallel to it.

In a word, to find *exact parallelism* it is necessary to examine the closest allies.

It is also of first importance to distinguish between the *existence* of generic or higher characters, and their condition under various circumstances of *individual life*. If a fœtal or larval character be conserved through the adult life of a type, it will be of course adapted to the functions of mature age. Thus the undeveloped character of the horns of the genus of deer, Rusa, are not accompanied with the marks of individual youth of the corresponding stage of Cervus; its individuals are fully grown and *functionally* perfect. The species of Hyla are not small and incapable of self preservation and reproduction, as is the corresponding stage of Trachycephalus; they are functionally developed. The student need not be surprised, then, if, when identity or exact parallelism is asserted, he finds some differences dependent on age and adaptation, for if he be an anatomist he need not be informed that a morphological relation constitutes types what they are, not a physiological.

II. *Of retardation and acceleration in generic characters.*

First. *Of adult metamorphosis.*

The question has necessarily arisen—have these remarkable relations between genera resulted from an arrangement of distinct generations according to a permanent scale of harmony, or have the same genetic series of individuals been made to assume the different positions, at the same or different periods of the earth's history.*

Prof. Marcel de Serres proposed the theory of repressions of development to account for the existence of the lower groups of animals *as now existing*, an error easily exposed, as has been done by Lereboullet in his various important embryological writings. But little observation is sufficient to prove that a mammal is not a shark where it has five gill arches or aorta bows, nor a batrachian where it has three, or a reptile where it has the two aorta-roots. This has been already sufficiently pointed out by Von Baer, who says there is "Kein Rede," of such a theory as was afterwards proposed by de Serres. Thus are true the rules propounded by this author.† 3. "Each embryo of a given animal type, instead of passing through the other given animal found, diverges still more from it." 4. "In the basis, therefore, the embryo of a higher animal type is never identical with an inferior type, but with the embryo only of the latter"

* Some naturalists seem to imagine that the demonstration of the existence of intermediate types is only necessary to establish a developmental hypothesis. Thus Dr. Dohrn (Ann. Magaz. N. Hist., 1868), writing of his discovery of that most interesting genus Eugereon, which combines characters of Neuroptera with those of Hemiptera, does not hesitate to say that it proves the truth of Darwin's theory. Now it appears to me that a demonstration of the existence of a regularly graduated succession of types from the monad to man, would be only the m nor of a syllogism without its major, in evidence for development, so long as the proof of transition of one step into another is wanting; and the idea that such a discovery could establish a developmental theory is entirely unfounded. Indeed the reasoning in which some indulge—if we dare so call the spurious article—based on this premise alone, is unworthy of science. The successional relation of types, though a most important element in our argument, has been long known to many who give no sanction to the idea of development.

† Entwickelungsgeschichte, 224.

I think that I have already made some progress in proving that the near or true generic relationship is one of absolute developmental repression or advance. Palæontology shows that families and orders, as now existing, were preceded in time by groups which are synthetic or comprehensive, combining the common characters of modern generic series. This process of synthesis must, it is obvious, if continued, result in the near approximation of the single representatives of the now numerous and diverse groups There is every reason to believe that a backward view through time will show this to have prevailed throughout the vertebrata and other branches, as we already can in part prove. And I have no doubt that the synthetic types, which represent modern orders, have existed in a generic relationship subordinate to the plan of the synthetic class, and that the latter have existed as genera only, of the type of the great branch. This is not ideal. We only have to look to our extinct ganoids, Archegosaurs, Labyrinthodonts, Compsognathus, Archæopteryx, Ornithorhynchus, etc., to realize these facts.

The first genera then formed a scale of which the members were identical with the undeveloped stages of the highest, and each to each according to their position.

Such a series of antitypic groups having been thus established, our present knowledge will only permit us to suppose that the resulting and now existing kingdoms and classes of animals and plants were conceived by the Creator according to a plan of his own, according to his pleasure. That directions or lines of development towards these ends were ordained, and certain laws applied for their realization. That these laws are the before-mentioned law of RETARDATION AND ACCELERATION; and law of NATURAL SELECTION.

The first consists in a continual crowding backwards of the successive steps of individual development, so that the period of reproduction, while occurring periodically with the change of the year, falls later and later in the life history of the species, conferring upon its offspring features in advance of those possessed by its predecessors, in the line already laid down partly by a prior suppression on a higher platform, and partly as above supposed, by the special creative plan. This progressive crowding back of stages is not, however, supposed to have progressed regularly. On the contrary, in the development of all animals there are well-known periods when the most important transitions are accomplished in an incredibly short space of time, (as the passage of man through the stages of the aorta bows, and the production of limbs in Batrachia Anura;) while other transitions occupy long periods, and apparently little progress is made.

The rapid change is called metamorphosis; the intervening stages may be called larval or pupal. The most familiar examples are those which come latest in life, and hence are most easily observed, as in the insects and frogs. When, during the substationary period, the species reproduces, a constancy of type is the result; when the metamorphosis only appears at the period of reproduction a protean type is the result; when the metamorphosis is crowded back to an earlier period of life, then we have another persistent type, but a new genus of a higher grade than its predecessor.

In reviewing many examples everywhere coming under the eye of the naturalist, it is easy to perceive what would constitute a *plastic* and what a *conserved* condition of generic, or even of specific form.

As one or more periods in the life of every species is characterized by a greater rapidity of development (or metamorphosis) than the remainder, so in proportion to the approximation of such a period to the epoch of maturity or reproduction, is the offspring liable to variation. During the periods corresponding to those between the rapid metamorphoses the characters of the genus would be preserved unaltered, though the period of change would be ever approaching.

Hence the transformation of genera may have been rapid and abrupt, and the intervening periods of persistency very long; for it is ever true that the macrocosm is a parallel or repetition of the microcosm in matter and mind. As the development of the individual, so the development of the genus. We may add—so the development of the whole of organized beings.

These metamorphoses may be fitly compared to those in the molecular constitution of matter. The force of cohesion between the atoms of a vapor steadily increases with descending temperature, and in a regular ratio, till a given point is reached, when a sudden metamorphosis to a denser, or liquid condition takes place. Nor have we reason to believe, with regard to many substances, that there is any parallel relation between the temperature and the molecular constitution before or after the metamorphosis takes place. So the temperature continuing to descend, the molecular character of the liquid remains unchanged until the *vis conservatrix* suddenly giving way at the ordained point, a solid is the result. Thus while the change is really progressing the external features remain unchanged at other than those points, which may be called *expression points*.

Now the *expression point* of a new generic type is reached when its appearance in the adult falls so far prior to the period of reproduction as to transmit it to the offspring and to their descendants, until another *expression point* of progress be reached.

Thus a developmental succession does not so obliterate the lines drawn around nature's types as to render our system ineffectual as an expression of them.

The successional acceleration or retardation in metamorphosis may be best illustrated in the cases selected above, by the following tables. These are taken, it will be remembered, from the Bufonidæ and Hylidæ as examples of "exact parallelism;" three are now added from the Ranidæ and Discoglossidæ. The case of "inexact parallelism" is that of the Scaphiopodidæ.

Whether they are cases of acceleration or retardation can only be determined by reference to the palæontology of the respective groups, or a careful comparison of times of metamorphosis. In the case of the Discoglossidæ I suspect it to be retardation, as the highest genus is extinct. The others I shall arrange with them for temporary convenience. Were I dealing with a group of Ganoids, I should imagine the process to be retardation, as this group is going out of existence. On the other hand, were they higher Oscine birds we might imagine the case to be reversed.

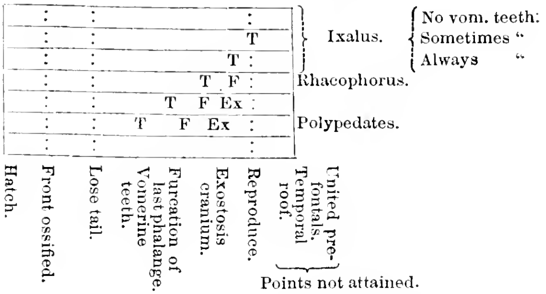
TABLE I.

Assumed,		Series No. 1.	No. 2.	No. 3
140th gen.	: :	Bombinator..	Hyla..................	Epidalea.
120th gen.	: e :	Alytes*	....	....
100th gen.	: e Pf : F	Discoglossus.	....	....
80th gen.	: e Pf F :	....	Scytopis..............	Bufo sp.
60th gen.	: e. Pf F Ex :	....	Osteocephalus......	Bufo sp.
40th gen.	: Pf : F Ex t	....	....	....
20th gen.	Pf : ?F : Ex t .	Latonia.......	Trachycephalus....	Peltaphryne.
1st gen.	: ? : :	....	....	....

Death.
Reproduce.
Temporal roof.
Exostosis.
Persistence audit'y apparatus. (Series 1 only).
Front ossified.
Lose tail.
Prefrontals meet (in series 1 and 3 only).
Hatched

* A parotoid gland of small size is added here, but is not generic as compared with Bombinator, as the latter has collections of crypts on the same region and over the body.

TABLE II.


Ixalus.
No vom. teeth:
Sometimes "
Always "
Rhacophorus.
Polypedates.
T
T
T F
T F Ex
T F Ex
Hatch.
Front ossified.
Lose tail.
Vomerine teeth.
Furcation of last phalange.
Exostosis cranium.
Reproduce.
Temporal roof.
United prefontals.
Points not attained.

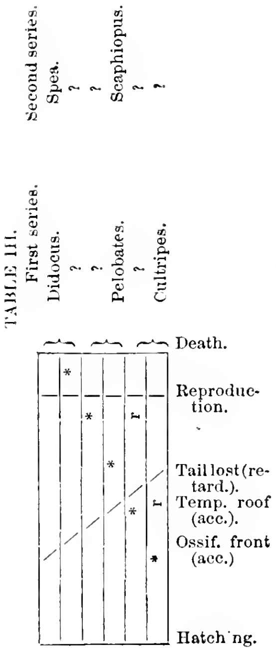


TABLE III.
First series.
Didocus.
?
?
Pelobates.
?
Cultripes.
Second series.
Spea.
?
?
Scaphiopus.
?
?
Death.
Reproduction.
Tail lost (retard.).
Temp. roof (acc.).
Ossif. front (acc.)
Hatching.

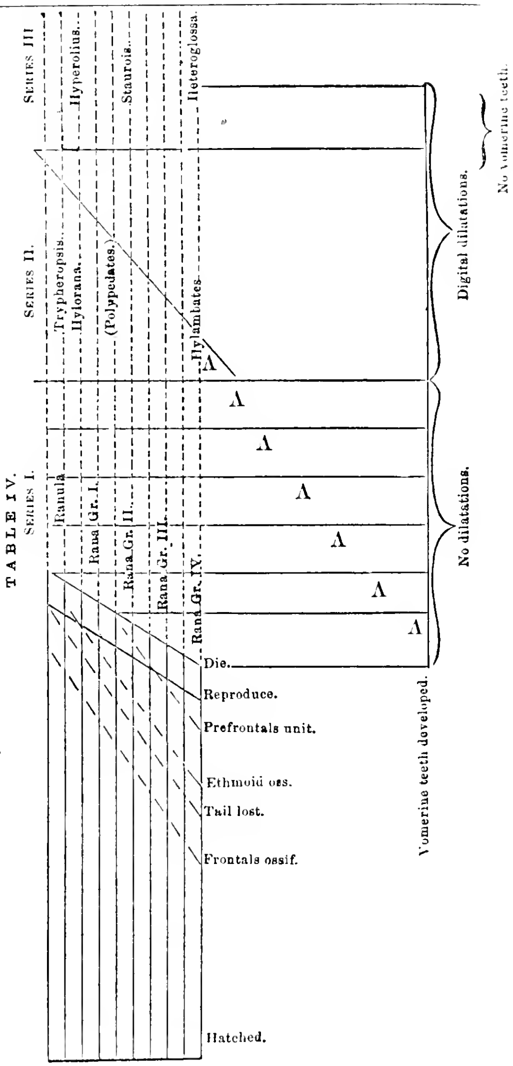


TABLE IV.
SERIES I.
SERIES II.
SERIES III.
Ranula
Rana Gr. I.
Rana Gr. II.
Rana Gr. III.
Rana Gr. IV.
Trypheropsis.
Hylorana.
(Polypedates.)
Hylambates.
Hyperolius.
Staurois.
Heteroglossa.
Die.
Reproduce.
Prefrontals unit.
Ethmoid oss.
Tail lost.
Frontals ossif.
Hatched.
Vomerine teeth developed.
No dilatations.
Digital dilatations.
No vomerine teeth.

In the preceding diagrams each horizontal column represents the life history of the individuals of each genus. The line of dots, stars, etc., represents the same developmental stage of each, as it appears earlier or later in the life of the individuals. The point of crossing the breeding period is that at which the character is rendered permanent. When the change falls on this period the character is not generic, as in Ixalus, Tab. II. The period of losing the tail, like that of breeding, is represented as occurring at nearly the same time in the history of every genus, as it is generally seasonal. Yet this is not always so, and like the other characters has most likely had its period of shifting. Compare difference of time of development, for instance, of the frontal and prefrontal bones in Tabs I. and IV. The comparison of the adult stages of the less developed genera, at the tops of the columns, with the larval conditions of those more fully developed, may be traced in the absence of characters which appear in the latter. I have convinced myself of the accuracy of the above relations by the examination of many skeletons and wet preparations of adults and larvæ.

The tables* are representations of nature, and not ideal sketches. It is to be noted as remarkable, that the advance throughout so many diverse groups is in the *same direction*, viz., to complete or excessive ossification of the cranium; and this identity of progress might be readily shown by adding other characters, were it not that the tables would become too complex for convenience.

Has any such transition from genus to genus ever been seen to occur?

It must of course take place during the life of the individuals of a species, and probably at different times during the lives of different individuals, dependent on their relative vigor. In our view, ordinary metamorphosis is such a change, and we have stated its bearing in this form, that "every character distinguishing suborders, families and genera is to be found among the individuals of some species, living or extinct, to mark new varieties or stages of growth."

α. *The developmental relation of generic to specific characters.*

For the relation of the law of retardation and acceleration to specific characters we will look to development again. While the young of Trachycephalus are successively different genera, they preserve most of their specific characters so as not to be mistaken. Agassiz says of the development of the North American turtles,† "I do not know a turtle which does not exhibit marked specific peculiarities long before its generic characters are fully developed." The same thing can be said of the characters of our salamanders, whose specific marks appear before their generic, or even family characters. I suspect that this will be found to be a universal law.

It also follows, if a developmental process, as proposed, has existed, that at times *the change of generic type has taken place more rapidly than that of*

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* Notes on the tables.—I. I characterized a genus Zaphrissa (Journ. A. N. S., 1866) from the Braunkohle (miocene) of Prussia, as different from Latonia, on the ground of the presence of a fontanelle in the exostosed frontoparietal bones. This combination of characters is very improbable, and appeared so at the time; but the appearance of the specimen is quite clear in this respect. I think, however, it must be the result of injury, and that the roof has been partially carried away.

Tab. II. Polypedates is here restricted to P. maculatus and P. quadrilineatus. The other species are referred to Rhacophorus, which has not hitherto rested on any proper basis; the asserted character—the palmation of the hands—being one quite graduated from species to species among Hylæ. *Chiromantis*, Peters, is referred to the same, as its character is not strongly marked and is visible in other species. For similar reasons *Leptomantis* is referred to Ixalus.

Tab. IV. In each of series II and III two series are mingled for the sake of comparing the structures of the prefontal bones. Thus Heteroglossa, Staurois, Hylorana and Trypheropsis are one series, and Hyperolius and Hylambates members of another.

† Contrib. N. Hist. United States, I., p. 391. Note.

specific, and that one and the same species (if origin be the definition,) has, in the natural succession, existed in more than one genus.*

Apart from any question of origin, so soon as a species should assume a new generic character it ceases, of course, to be specifically the same as other individuals which have not assumed it. If supposed distinctness of origin be, however, a test of specific difference, we shall then have to contend with the paradox of the same species belonging to two different genera at one and the same time.

It follows, therefore, in our interpretation of nature, that groups defined by coloration alone are not to be regarded as genera, as is done by some ornithologists and entomologists. They are simply groups of species in which distinctive generic characters had not appeared up to the period of reproduction. Inasmuch as in development certain specific characters appear first, among them part or all of the coloration pattern, it is obvious that the latter do not belong to the generic category. The employment of such characters then, in this sense, is only to commence reversing the terms generic and specific, and to inaugurate the process of regarding each species as type of a separate genus.

β. Of probable cases of transition.

Thus the transition between the toothed and edentulous conditions in Cetacea takes place in the ordinary growth of the individuals of the genus Globiocephalus, and the transition between the ossified and non-ossified types of Chelonia occurs during the life of the individuals of the genus Dermatemys.

But in attempting to demonstrate this proposition we must bring forward facts of another kind. The anti-developmentalists are accustomed to put such changes aside, as part of the necessary history of established types; hence we will not appeal to such.

1. The frog Ranula affinis, of South America, was described by Peters as probably a climatal variety of European Rana temporaria. In this he is supported by the fact that the specific characters do not differ more than would characterize it as a local variety, were it an inhabitant of Europe. But I have found that it differs generically in the non-ossification of the ethmoid bone, as has been confirmed by Steindachner, and represents an embryonic condition of the same bone in Rana. It is in fact an undeveloped Rana. That this is a true genus is confirmed by many specimens, by an additional species (R. palmipes), and by the fact that the allied genus Trypheropsis, embracing three species in the same region, differs in the same way from the otherwise identical genus of the Old World, Hylorana.

2. The South African Saurians Chamæsaura anguina, and Mancus macrolepis, are very closely allied in specific characters in all respects, though distinct. They have one important ground of generic distinction; the latter has one pair of limbs less than the former. They are rudimental in Chamæsaura, and the disappearance in Mancus is but another step in the same direction. The difference in specific characters is of much less degree.

3. In the genus Celestus there are numerous species, which range from a slender, snake-like form with weak limbs, to stouter, strong-limbed forms with a more saurian build. Among these the Haytian C. phoxinus is well disguished by form and coloration. An allied genus from the same region is Panolopus, which in specific characters approaches the C. phoxinus very closely, much more so than any Celestus (one species possibly excepted). But in generic characters it is distinguished by the loss of all its toes and the non-separation of nine plates on the end of the muzzle. The genus Diploglossus, on the other hand, occupying a superior place on account of the division of the frontonasal into three, is, in specific characters (of D. monotropis) much

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* See Proceedings Academy, 1867, p. 86, where I observe that generic characters are probably less inherent than specific.

closer to the stout Celesti than the species of the latter genus are among themselves.

4. The Gronias nigrilabris is a Silurid, which in specific characters more nearly resembles the Amiurus lynx, than the latter does the A. albidus and many other species of the genus. The A. lynx is found in the same streams. The important generic character, the absence of eyes, is, however, its constant feature (in three specimens known to naturalists, others to fishermen).

5. The Cinclidium granulatum, a large tree toad of Brazil, resembles in all its characters the Centrotelma geographicum. The specific differences between them amount to almost nothing, but both sexes of the former grow larger and are furnished with a generic peculiarity in the addition of some phalanges to the thumb.

6. The Auk Sagmatorrhina suckleyi Cass. is stated* to resemble in plumage and all its characters the Ceratorhyncha monocerata, as to be not distinguishable, even as a variety from it, except by the striking generic characters. In the latter a concave bone-like process rises from above the nostril, and an accessory piece is found in the symphysis mandibuli, both wanting in the genus Sagmatorrhina.

7. The Oporornis agilis Baird, a North American bird of the Tanager family, resembles very closely in form, color and habits, the adjacent species of the adjacent genus Geothlypis. While its specific characters are thus very close to Geothlypis tephrocotis, it differs in the generic feature of a longer wing. By this it is associated, and properly so, with another species, O. formosus, which has the general color and habits of species of Myiodioctes (M. canadensis), the next related genus.

8. The following fact I give on the authority of Prof. Leidy, who will publish it in his forthcoming work on the extinct mammalia of Nebraska, etc.

Three species of Oreodon occur in the miocene strata; they are a larger, a medium and a small sized species. In the Pliocene beds above them they are represented by three species of Merychyus, which are in all respects known, identical specifically with the three preceding. Each one may thus be said to be more nearly allied to the species of the other genus than to its fellow of the same genus, in specific characters. But each, on the other hand, differs from each in generic characters. The teeth of Merychyus are more prismatic, have longer crowns and shorter roots, approaching the sheep, as Oreodon does the deer.†

9. The North American Centrarchoid, Hemioplites simulans, in specific characters is most closely allied to the Enneacanthus guttatus Morris.* It has however one or two distinctive specific features, but it differs as to genus in having one less dorsal spine and one more anal spine, characters in the direct line of succession of genera to Centrarchus and Hyperistius. Now the lack of one of its dorsal spines is not an uncommon variation in the Enneacanthus, but the anal is never known to change. There is, however, apparently no reason, as far as physical causes are concerned, why it should not tend to vary as much as the dorsal. The lack of this tendency constitutes Hemioplites, a genus distinct from Enneacanthus, *at the present time.*

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* By Coues Monograph of Alcidæ. Proc. Acad. Phila., 1868, p. 34.

† This phenomenon suggests an explanation on the score of adaptation, which the other cases do not. The existence during the later period of a tougher material of diet, would increase the rapidity of wearing of the crown of the tooth, and require a longer crown and greater rapidity of protrusion. This necessitates a diminution of the basal shoulder and shortening of the roots, producing the prismatic form aforesaid. The deer browse on forest foliage, which is more tender, while the Cavicornia graze the grasses, which contain, as is known, a greater amount of silex; hence the more rapid attrition of the tooth.

This may have been the case with the two extinct genera; the different periods during which they lived may have seen a change from forest to prairie. (It is not intended to insinuate that the species of the two genera are necessarily of the same or any given number.)

Those naturalists (who are not a few) who will be disposed on this account to deny generic rank to Hemioplites, will have, on the same grounds, to unite each succeeding step till they embrace the "series," and no doubt at the same time belie a considerable amount of their own work already done.

10. The Coreopsis d i s c o i d e a T. and G , var. *anomala* Gray, is much more nearly allied to Bidens f r o n d o s a than to other species of its own genus, and the latter is nearer to it than to other species of Bidens. It differs chiefly, if not altogether, in the generic character: the barbs of the achenia are directed upwards; those of the Bidens downwards.

From these and many other such instances it may be derived: *That the nearest species of adjacent genera are more nearly allied in specific characters than the most diverse species of the same genus.*

11. While Taxodium d i s t i c h u m and Glyptostrobus e u r o p æ u s, conifers of North America and of Eastern Asia, respectively, are readily distinguished by generic peculiarities of their cones; in specific characters they appear to be identical.*

Confirmatory of this proposition is the statement of Parker:† "In tracing out the almost infinite varieties of the modifications of any one specific type of shelled Rhizopod, my friend, Prof. Rupert Jones and I found that *like varieties of distinct species are much nearer in shape and appearance than unlike varieties of the same essential species.*" (It is not unlikely that species should here be read genus and variety species, though the latter may not fulfil the requirements in regard to distinctiveness observed among higher animals. In types like the Rhizopod, forms of this grade may not be really differentiated. Their enormous geographical range would suggest this, if nothing else.)

Objection.—A class of objectors to the preceding explanation of the relations in question, will ascribe them to hybridization. They have already done so to considerable extent among the Teleosts, (see the writings of Von Siebold, Steindachner and Günther). That hybrids exist in nature will be denied by none, but that they are usual or abundant is not a probable condition of a creation regulated by such order as ours is. The tendency to modify in given lines of generic series, if admitted, will account for many of the cases regarded as hybrids by the above authors, for it is to be remarked in many cases how the generic characters are strikingly affected, and are chiefly used in guessing at the parentage. This is among Cyprinidæ so much the case that their is scarce an example of a hybrid between two species of the same genus brought forward, but often between species of different genera.

If any two forms should hybridize freely, the circumstance should prevent their recognition as distinct species.

γ *Ascertained cases of transition.*

This naturally suggests that in accordance with the theory of acceleration and retardation, a transition can take place in the life history of species. Have we any means of proving this suspicion?

1. The genus Ameiva (Saurians of South America) has been composed of species of moderate size furnished with acutely tricuspid teeth. Teius, on the other hand, embraces very large species with the molars obtusely rounded and of the grinding type. These genera are generally held to be well founded at present. I find, however, that in Ameiva p l e i i, which is the largest species of the genus, that in adults the greater part of the maxillary and mandibular teeth lose their cusps, become rounded, then obtuse, and finally like those of Teius. While young, they are true Ameivæ. Strangely enough the A. p l e i i, from Porto Rico, acquires but three such obtuse teeth when of the size of the other (St. Croix) forms. In youth the teeth of all are as in other Ameivæ. Here is a case of transition from one genus to another in the same species.

* See Meehan, Proc. Amer. Ass. Adv. Sci. 1868. Newberry, Ann. Lyc., N. Y., 1868.
† Transac. Zool. Soc., London, 1864, 151.

2. In the important characters of the possession of branchiæ, of maxillary bones, and of ossified vertebræ, the tailed Batrachia presents a series of a rising scale, measured by their successively earlier assumption. Thus Salamandra a t r a* produces living young, which have already lost the branchiæ; S. m a c u l o s a living young with branchiæ; Plethodon † produces young from eggs which bear branchiæ but a short time, and do not use them functionally; Desmognathus n i g r a uses them during a very short aquatic life; D. f u s c a and other Salamanders maintains them longer, while Spelerpes preserves them till full length is nearly reached. Finally species of Amblystoma reproduce while carrying branchiæ, thus transmitting this feature to their young as an adult character And it is a very significant fact that Spelerpes, which bears branchiæ longest, next to Amblystoma, is associated in the same zoological region with a genus (Necturus) which differs from its four-toed form (Batrachoseps‡), in nothing more than the possession of the osseous and branchial characters of its larva, in a permanent and reproducing condition. That this is a genus, to be one day converted into Batrachoseps by an acceleration of its metamorphosis, or that has been derived from it by the reverse process, I am much inclined to believe. In support of this I quote the following examination into the time of change of the species of Amblystoma from my essay on that genus.§

"The great difference between the different species, and between individuals of the same species in this respect, may be illustrated by the following comparison between the size of the animals at the time of losing the branchiæ so far as known, and that to which they ultimately attain.

Species.	Size at loss of branchiæ.		Average full size.	
	In.	Lines.	In.	Lines.
A. jeffersonianum,	1	5·75	6	
A. punctatum,	1	10	6·1	6
A. conspersum,	1	10·5	2	7·5
A. opacum,	2	2	3	9·5
A. texense,	2	1	?	
A. microstomum,	2	3·5	4	
A. talpoideum,	3 (perhaps too large)		3	9·5
A. paroticum,	3	7·5 (not smallest.)	7·2	2·5
A. tigrinum,	3 6	7 to 7	8 to 10	
A. mavortium,	3 8	9·5 to 0	8	9
A. mexicanum,	? branchiæ persistent.		8	

The last species, though not uncommon in collections, is not known to pass through its metamorphoses in its native country, but reproduces as a larva, and is therefore type of the genus *Siredon* of Wagler, Cuvier, Owen and others. The larva of A. m a v o r t i u m in like manner reproduces, but their offspring have in the Jardin des Plantes and at Yale College undergone an early metamorphosis.‖

Here is a case where all the species but two change their generic characters; one changes them or not, according to circumstances, and one does not change them at all. What are the probabilities respecting the change in the first set of species?

* See Schreibers Isis, 1833, 527: Kœlliker, Zeitschr. f. Wissensch. Zoologie, ix, 464.

† Baird Iconographic Encyclopædia, Wyman, Cope.

‡ See Cope, Journ. Ac. Nat. Sci., Phila., 1866.

§ Proceed. Academy, 1867.

‖ Through the kindness of Prof. Dumeril, I have received both larvæ and adult of the species here noted, and observed by him. The larva is as he states, *Siredon lichenoides* of Baird, while the adult is his Amblystoma m a v o r t i u m, not A. t i g r i n u m (= *luridum*) as also supposed by Dumeril.

As we know from the experiments of Hogg, Duméril and others that metamorphosis is greatly hastened or delayed by the conditions of temperature and light, what would not be the effect on such a protean species of a change of topographical situation, such as the elevation or depression of the land? And I have no hesitation in saying that if the peculiarities of series of individuals of A. tigrinum and A. mavortium, in the respects above enumerated, were permanent, they would characterize those series as species, as completely as any that zoologists are accustomed to recognize. For the evidences on this head, see the discussions of those species in my monograph.

The experiments of Hogg above alluded to, are as follows, as given by him in the Annals and Magazine of Natural History.

He placed a number of impregnated ova of frogs in vessels arranged at regular distances from the light, in a cave. The lessening degrees of light were of course accompanied by a corresponding but much less rapid decline in temperature. The resulting effects on the metamorphosis may be tabulated as follows:

Mo.	day.	60°	56°	53°	51°
3	11	Egg.	Egg.	Egg	Egg.
	20	Larva free,	*	*	*
	25	*	Larva free,	*	*
	31	*	*	Larva free,	Larva free,
4	10	Larva very large,	*	*	*
	22	Metam. complete,	Larva large,	Larva large,	Larva small,
8	11		Metam. complete,	*	*
	28			Metam. complt.	*
10	31				Metam. comp.

3. The reproduction of some species of insects before they complete their metamorphosis is a well-known fact, and it is particularly to the point that, in many of them, some individuals do attain to their full development, while the many do not. Westwood says,* "two British species of this family (the Reduviidæ), Prostemma guttula and Coranus subapterus, are interesting on account of their being generally found in an undeveloped state, the latter being either entirely apterous or with the fore-wings rudimental, although occasionally met with having the fore-wings completely developed. "I think," says Spinola, "that the presence of wings and their development depends on the climate," and in speaking of Oncocephalus griseus, he says "the influence of the northern climate appears to have arrested the development of the organs of flight." It will be seen that I have referred elsewhere that I have noticed that it is especially in hot seasons that certain species acquire, while the circumstance noticed respecting the ordinary occurrence of winged specimens of Microcœlia in the West indies is confirmatory of the same opinion."

4. It is now known that certain Orthoptera do not get through their metamorphosis in time for the period of reproduction, and hence never or in rare instances only develope more than a short distance beyond the pupa state.

5. My friend, P. R. Uhler, tells me of an example among Hemiptera of the genus Velia. The species V. rivulorum Fab., and V. currens* of Europe, are only distinguished by the developmental feature of the presence of wings in one, and their absence in the other. Another species of the tropical region of the West Indies, Halobates americanus Uhler, is furnished with wings, while its individuals which occur abundantly in North America have been generally supposed to lack them. Individuals, however, no doubt occur whose developments is so far accelerated as to permit them to acquire wings before the period of reproduction, since one such has been found by Uhler.

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* Uhler informs me that Amyot's asserted color characters are not reliable.

These wing characters are in many cases generic, it appears to the writer; and the fact that they differ without corresponding specific differences, is important evidence as to the origin of genera.

6. The females of the Lepidopterous genus Thyridopteryx never develope beyond the pupa state, according to the same authority, before reproduction; they are reproducing pupæ, so far as the external characters concerned in metamorphosis go. In other words, the latter have been retarded, while the reproductive system and others have progressed. Now generic characters are seen in the first, not in the last. The influence of the males is sufficient to prevent more than a part of the offspring from being retarded in the same manner.

I have selected a few of this class of facts which have come before my mind during the present writing, as drawn mainly from my own experience. How many more of the same purport could be found by search through the great literature of science or in the field of nature, may be readily imagined. I have no doubt that the field of Entomology especially will furnish a great number of evidences of the theory of acceleration and retardation, especially among the insects with active pupæ.

Finally, having already stated the law according to which these processes naturally take place, I quote the following significant language of Hyatt in the above quoted essay on the Cephalopoda, as approaching nearer to the "law of acceleration and retardation," than any thing I have found written. He says:

"In other words there is an increasing concentration of the adult characteristics of lower species, in the young of higher species, and a consequent displacement of other embryonic features, which had themselves, also, previously belonged to the adult periods of still lower forms."

The preceding propositions have been formulated as follows; a few additions being now made:

I. That genera form series indicated by successional differences of structural character, so that one extreme of such series is very different from the other, by the regular addition or subtraction of characters, step by step.†

II. That one extreme of such series is a more generalized type, nearly approaching in characters the corresponding extreme of other series.

III. That the other extreme of such series is excessively modified and specialized, and so diverging from all other forms as to admit of no type of form beyond it.‡

IV. That the peculiarities presented by such extremes are either only in part or not at all of the nature of adaptations to the external life of the type.§

V. That rudimental organs are undeveloped or degraded conditions of the respective characters developed or obliterated in the extreme of the series.

VI. That the differences between genera of the same *natural* series are only in the single modifications of those characters which characterize the extreme of that series.

VII. That the relations of the genera of a primary series, are those of the different steps in the development of the individuals of the extreme genus *ab ovo* (*Von Baer*, *Agassiz*) (with sometimes the addition of special adaptive features??)

VIII. That the presence, rudimental condition, or absence of a given generic character can be accounted for on the hypothesis of a greater rapidity of de-

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* On Insects, II, 473.

† St. Hilaire, Owen, Agassiz, Duméril.

‡ Dana on Cephalization; Leconte.

§ Owen on Cetacea, Trans. Zool. Soc., Lon., 1866, 44. Leconte on Carabidæ, Trans. Amer. Philos. Soc., 1853, 364.

velopment in the individuals of the species of the extreme type, such stimulus being more and more vigorous in the individuals of the types as we advance towards the same, or by a reversed impulse of development, where the extreme is characterized by absence or "mutilation" of characters.

IX. And that as the character of the genus at the period of reproduction of its species, is that which is perpetuated;

X. So the character of the genus has been first inferior, then protean, and then advanced, as the metamorphosis has been by a retrograde movement in time, posterior to, at, or anterior to the period of reproduction.

XI. That it therefore results that there is one primary structural type involved in such a series of species, which is made to present at any given period in its Geologic history that appearance of succession of genera ordained by Creative Power.

δ. On the origin of inexact parallelism.

The hypothesis can only be demonstrated in case of *exact parallelism.* If proven in these, it readily accounts for the cases of *inexact parallelism*, which are of course in any single period vastly in the majority. First take the case of *simple inexact parallelism.* A series of individuals of the genus Didocus undergo the metamorphosis of the cranial structure earlier and earlier in life, commencing by completing the ossification of the perichondrium of the fronto-parietal region in full age, until at last it becomes completed as early as the period of reproduction. Heretofore the adult offspring have appeared during a long period, invariably characterized by the larval cranium, but like now producing like, this development springs into new power, and the offspring ossify the cranial bones far earlier than their immediate predecessors; in a word, the genus Pelobates has been created! At this state of progress Didocus is an undeveloped Pelobates.

Let us, however, suppose the "acceleration" of development of the cranial bones still to progress. The character appears now soon after the ordinary metamorphosis has been passed, and now a little before. The identity of Didocus with the undeveloped Pelobates is thereupon lost!

So may have been the relations between Pelobates and Cultripes. Pelobates was probably once identical with the undeveloped Cultripes, but the same acceleration has concentrated the characters more rapidly than the other larval stages, leaving Pelobates behind.

This I conceive to be the explanation of this relation: when the parallelism is inexact by two steps, as in Spea to Didocus, by the obliterated ear and ossified xiphisternum. The continued concentration of characters has been carried to earlier stages till the identity exists in the adult state of neither one, but at a period of larval life of both, shortly preceding the adult period of the lower. The relations between the Amblystomidæ and Plethodontidæ, which I have elsewhere* pointed out, have probably had their origin in this way.

If we attempt to prove the identity of the modern mammalian fœtal circulation with that of the modern adult fish, we may find nearly an exact parallel in this respect, as it is the basis of class distinction; but in other respects the identity will not exist, rendering the parallel inexact or remote The structure of the origins of the aorta is at one time identical with that of the shark, with one exception—in the former but four aorta-bows appear together; in the latter five. In the former the first disappears as the fifth comes into being. This is simply a continuation of *acceleration.* The first generalized representative of the Mammalia lost the first aorta-bow towards the latter part of its growth, and became the next genus in advance of the selachian. The fact that these bows do not appear exactly simultaneously, but rather successively, renders it necessary that in a regularly shortening period of possession of

* Jour. Ac. Nat. Sci., Phil., 1866, 100.

transitory characters, one such, as the existence of the first aorta root, should vanish before the appearance of a permanent, the fifth, in the more specialized types, where acceleration reaches its maximum. This is indicated by the fact that in the Batrachia, where the acceleration has not attained so high a degree, the first and fifth aorta-bows coexist for some time, though the first and second disappear before maturity.

So also with the splitting of the bulbus arteriosus. As in the Batrachia, the pulmonary *ductus communis* only is to be separated, the remaining bulbus is divided by a long valve or incomplete septum, tracing the division of the aorta roots. In the serpent (Rathke), this division is so accelerated as to appear at nearly the same time as the septum of the pulmonary duct. In the mammal, on the other hand, while the division of the aorta root takes place as soon as in the last, the pulmonary septum is accelerated so as to appear long before the first named. Hence in the septa in the serpent, the singular anomaly seems to present, of the mammal passing through the Batrachian stage while the serpent, a nearer relative, does not.* If, however, we take the less typical serpent, we will find the aortic septum to appear a little later, thus giving the Batrachian type, and if we reverse the order of time, so that the succession becomes one of retardations, we will find the same known ratio will bring us to an identity under all circumstances.

This then is the explanation of the divergence and want of "exact parallelism" which is observed in comparing the developmental histories of all types *not most closely allied*. *It has not*, according to our theory, *always been* a divergence, but was at a prior epoch in each case a relation of "exact parallelism," the lower type a repressed higher; the former identical with one of the stages of the latter. But the process which has produced this relation, continued, has of necessity destroyed it, so that the exact parallelism has always been a temporary relation, and one shifting over the face of the system.

III. *Of higher groups.*

First ; comparison of the cotemporary.

Having now admitted a developmental succession of genera, and second, that this has progressed more rapidly at certain times in the earth's history than any modification of specific forms, the hypothesis already broached naturally comes up. *Has such transformation of types, generic or higher, taken place in any degree simultaneously, throughout a great number of species?* An affirmative answer to such a proposition is absolutely necessary to its acceptance as expressing the phenomena exhibited by geological succession of types. Let us try to answer the question put in a closer form. Have the same species been transferred from one geologic epoch to another by a change of generic form ; and has not the genus been transferred from one epoch to another under change of ordinal type? and as a consequence the same species?

As a reply, I propose to render the affirmative of the first of these questions highly probable.

Palæontology only will be able to answer this question conclusively, though as we have abundant evidence that the relations of species to genera and other higher groups were the same then as now, we may look to the present status as furnishing important evidence on the subject. We are turned at once to the probable history of development in the separate zoological areas of the earth's surface. The question may be asked, Are the present zoological regions on an equal plane as to the geologic relations of their faunæ, or are they related as the different subdivisions of a geologic period in time?

I have on a former occasion asserted that the latter of these propositions was true.†

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*This is the way indeed in which it is stated by Rathke, Entwickelungsgeschichte der Natter p. 164.

† On Arciferous Anura, Journ. Ac. Nat. Sci., 1866, 108.

α. Of homologous groups.

Naturally following the admission of a developmental succession of organic beings, is the question of its relation to the different surfaces of land and water on the earth. The following considerations bear on this subject.

Among the higher groups of animals can be detected series "homologous" on the same principle as the alcohols (? compound radicals) and their derivatives; and the component types of each can be, and have been in many instances, shown to be "heterologous," as are the ethers, mercaptans, aldehydes, acids, etc. Among Mammalia two partly homologous series have been pointed out, Implacentialia and Placentialia;* possibly such are the types Altrices and Pracæoces among Aves; of a lesser grade in this class are the parallel series of Pullastræ and Gallinæ, of Clamatores and Oscines. Among Tortoises I have alluded to the Pleurodira as compared with the remainder of the order, already parallelized by Wagler; and of lesser grades, the series among Lacertilia of Acrodonta and Iguania, parallelized by Duméril and Bibron, and of Teidæ and Lacertidæ, compared by Wiegmann. I have discovered a full parallelism between the Raniform and Arciferous Anura. It is carried out between the Characini and a group of remaining Physostomous Fishes, perhaps not yet well defined; it is exhibited between the orders Diptera and Hymenoptera among insects. None of these comparisons can be allowed, of course, without the most searching anatomical and embryological analysis.

This *heterology* is what Swainson and others called "analogy" as distinguished from affinity. It *generally* relates genera of different zoological regions. Mimetic analogy, on the contrary, relates genera of the same region; it is a superficial imitation which has occurred to critical biologists, and is of much interest, though as yet but little investigated. It has as yet been observed in external characters only, but occurs in internal also; it has been accounted for in the first case by the supposed immunity from enemies arising from resemblance to well defended types. No such explanation will, however, answer in the latter case. I believe such coincidences express merely the developmental type common to many heterologous series of a given Zoological "Region;" this will be alluded to a few pages later.

We naturally inquire, is there anything in the food, the vegetation, or the temperature to account for this apparent diversity in the different regions? Are there not carnivora, herbivora, seed-eaters, insectivores, and tree climbers, where game and grass, seeds and insects and forests grow the world over? We answer undoubtedly there are, and these adaptations to food and climate are indeed as nothing in the general plan of creation, for every type of every age has performed these functions successively.

β. Of Heterology.

This relation will be exhibited by a few examples from groups known to the writer, commencing with the Batrachia Anura.

	Raniformes.	Arciferi.
External metatarsal free.		
Aquatic.	Rana.	Pseudis.
Metatars. shovel.	Hoplobatrachus.	Mixophyes.
External metatarsal attached.		
	Feet webbed.	
Metatars. shovel.	Pyxicephalus.	Tomopterna.
Arboreal; vom. teeth.	Leptopelis.	Hyla.
" no " "	Hyperolius.	Hyleila.
Subarboreal.	Hylambates.	Nototrema.
	Feet not webbed.	
Terrestrial.	Cassina.	Cystignathus.
" spurred,	Hemimantis.	Gomphobates.

Comparing the genera in a general physiological sense we may parallelize further.

Aquatic, with digital dilatations.	Heteroglossa.	Acris.
Arboreal; cranium hyperostosed.	Polypedates.	Trachycephalus.
" cranium free.	Rhacophorus.	Hyla. Agalychnis.

The same kind of parallels exist between the primary groups of the Testudinata, as follows:

	Cryptodira.	Pleurodira.
Five complete pairs of bones across the plastron.	Pleurosternidæ.	Sternothæridæ.
Four pairs of bones across plastron; not more than two phalanges on all toes.	Testudinidæ.	Pelomedusidæ.
Three phalanges on most digits;		
Zygomatic arch; no parieto-mastoid.	Emydidæ.	Podocnemididæ.
Temporal fossa overroofed by parietal.	Macrochelys.	Podocnemis.
No zygoma; a parieto-mastoid arch.	* *	* Hydraspididæ.

If we compare the peculiarities of generic structure merely with reference to their adaptation to the animals habits, we will see the following:

	Cryptodira.	Pleurodira.
Feet reduced for terrestrial progress.	Testudinidæ.	Pelomedusidæ.
Feet normal.		
Anterior lobe of sternum moveable.	Cistudo. Cinosternum.	Sternothærus.
Anterior lobe fixed.		
Neck very elongate.	Trionychidæ.	Chelodina.
Neck shorter; aquatic.		
Temporal fossa open.	Emydidæ in gen.	Hydraspididæ.
Temporal fossa over-roofed.	Cheloniidæ.	Podocnemis.

The parallels between the genera of the American Iguanidæ and the old world Agamidæ are similarly quite close.

	Iguanidæ.	Agamidæ.
Abdominal ribs.	Polychrus.	* *
No abdominal ribs.		
Ribs greatly prolonged into a lateral wing.	* *	Draco.
Ribs not prolonged.		
Arboreal types, generally compressed.		
A dorsal and caudal fin supported by bony rays.	Basiliscus (no fem. pores)	Lophura (pores.)
No vertebral fin.		

	No femoral pores.	
Form slender, scales in equal series,	Calotes. Bronchocela.	Læmanctus.
Form elongate; eyebrows elevated, tail compressed.	Gonyocephalus.	Ophryoëssa.
Form stouter, scales less regular:	Hypsibates.	Tiaris.
	Femoral pores.	
Low crested; small hyoid disk.	Brachylophus.	Diporophora.
High crested; large hyoid disc.	Iguana.	Physignathus.
Tail with spinous whorls.	Cyclura.	* *
Terrestrial types of flattened form.		
	Femoral pores.	
Tail with whorls of spiny scales.	Hoplocercus.	Uromastix.
Tail long, simple; scales small.	Crotaphytus.	Liolepis.
Tail simple, scales large.	Sceloporus.	* *
	No femoral pores; preanal pores.	
Tail with whorls of spines.	* *	Stellio.
Tail simple, not elongate, ear open.	Proctotretus.	Agama.
	Neither femoral nor anal pores. Much flattened, tail short, scales irregular.	
Ear exposed.	Phrynosoma.	Moloch.
Ear concealed.	(Doliosaurus, s. g.)	Phrynocephalus. Megalochilus.

A similar parallel may be drawn between the American Teidæ, and the old world Lacertidæ, and in fact between all the families of the Lacertilia Leptoglossa. I have added to these for comparison two families of the Typhlophthalmi. Each family embraces one or more series, and these exhibit a remarkable similarity in the relative development of the limbs and digits; among the higher groups the parallelisms lie in the arrangement,—as greater or less separation, of the head shields. The Scincidæ are cosmopolite; the Gymnophthalmidæ, which have the eyelids of their fœtus, are Australian; the Sepsidæ, either larval or senile in head shields, are mostly Æthiopian.

The first comparison of these groups was made by Wiegmann (Herpetologia Mexicana,) who employed, however, only the Scincidæ and Lacertidæ, and could not include the many types made known since his day.

From the class Aves I have selected only the homologous series of the Clanatorial and Oscine Passeres. Naturalists more fully acquainted with the genera could probably increase the examples of heterology largely. Each group furnishes us with carnivorous, insectivorous and frugivorous forms; each with walkers, climbers, and sedentary genera; each with butcher-birds, thrushes, warblers (not in song !), wrens and fly-catchers. Each and all of these types are *teleologically* necessary to any country complete in the wealth of nature, and to each geological period.

Two pair limbs. I. Toes 5—5.	*Lacertidæ.*	*Teidæ.* (*no supranasals.*)	*Anguidæ.*	*Gymnopthalmidæ.*	*Scincidæ.*	*Sepsidæ.*	*Pygopodidæ.*	*Acontiadidæ & Anelytropidæ.*
A. Scales granular.	Lacerta. Eremias.	Ameiva. Cnemidophorus.						
B. Scales imbricate.	Notopholis.							
Supranasals. Prefrontals, 2. (divided.)	Gerrhosaurus.	Centropyx.	Diploglossus.	Morethia.	Euprepis. Eumeces.			
Prefrontals, 0.	Pleurostrichus.		Celestus.			Amphiglossus. Sphenops. Gongylus.		
No supranasals.	Platysaurus.... Cicigna.	Cercosaura. Iphisa. Ecpleopus. Lepidosoma.		Cryptoblepharus. Ablepharus.	Cyclodus. Hinulia. Mocoa.			
II. Toes 4—5.		Tretioscincus. (Acrantus.)		Menetia. Gymnophthalmus.	Campsodactylus. Ristella. Heteropus.			
III. Divided 3—3 to 2—3 times.	Saurophis.	Brachypus.	Sauresia.	Miculia. Blepharactisis.	Tetradactylus. Chiamela.	Sepsina. Anisoterma, (2—4)		
IV. Divided 1—2 or 2—1 or 2—2.		Chalcis.		Lerista.	Anomalopus. Siaphus. Hemiergus. Chelomeles.	Seps. Heteromeles. Sphenocephalus. Sepomorphrus.		Nessia.
V. One limb divided.		Ophiognomon.			Brachymeles. Rhodona.			
VI. Neither divided.	Cætia. Chamæsaura.		Panolopus.					Evesia.
One pair limbs.	Maneus.		Pseudopus.			Scelotes.	Pygopus. Delma. Pletholax.	Dibamus.
No limbs.			Opheodes. Opheosaurus. Anguis. Ophcomorus.		Soridia.		Aprasia.	Herpetosaura. Acontias. Typhlosaurus. Feylinia. Anelytrops.

Clamatores.		Oscines.

I. Tree-climbers, with long hind toe and tail feathers stiffened and acute.

Dendrocolaptidæ.		*Certhiidæ.*

II. Terrestrial in part, with the tertials as long as the primary quills.

Geobatidæ.		*Motacillidæ.*

III. Tree-perchers with hooked bill, graduating from powerful to medium and slender.

Formicariidæ.		*Turdidæ.*
Thamnophilus.	Bill strongest, hooked.	*Lanius.*
Formicarius.	" moderate.	*Turdus.*
Formicivora.	" weak.	*Sylvia.*
Rhamphocæmus.	" slender (wrens).	*Troglodytes.*

IV. Fly-catchers with flat bill and weak legs; wait for their prey and take it on the wing.

Tyrannidæ.		*Muscicapa* et aff.

V. Flat-billed berry and fruit eaters.

Cotingidæ.		*Bombycillidæ.*

From the Mammalia the well-known series of the Marsupialia and Placentialia may be chosen.

Placentialia.		Marsupialia.

I. Toes unguiculate, in normal number; sectorial teeth; *i. e.*, one or more molars with one or no internal tubercles; canines strong:

Carnivora.		*Sarcophaga.**
	I. Digitigrade.	
	Toes 5—4.	
	b. Numerous sectorial tuberculars.	
	Tubercular molars $\frac{2}{2}$.	
Canidæ.		* *
	Tubercular molars $\frac{4}{4}$ (upper incisors more numerous in some).	
* *		Thylacinidæ.
	II. Plantigrade; molars tubercular.	
	a. Posterior molars $\frac{4}{4}$.	
* *		Dasyuridæ.
	aa. Posterior molars $\frac{2}{2}$.	
Ursidæ.		* *

II. Toes unguiculate; molars with more than one row of pointed tubercles; canines weak or none; incisors large.

Insectivora.		*Entomophaga.*
	a. True molars $\frac{4}{4}$, toes 4—5.	
	Tail naked.	
Gymnura.		Didelphys.
	Tail hairy.	
Cladobates.		Myoictis.

IV. Molars with transverse crests, no canines; tusk-like incisors; pairs of limbs of similar proportions.

* Flower and Krefft show that the supposed carniverous Thylacoleo Ow. is allied to Hypsiprymus, and probably similar in habits.

Proboscidia.		*Diprotodontidæ.*
	Two inferior incisors; molars with two cross-crests; size huge.	
	a. Two rudimental lateral incisors above.	
* *		Diprotodon.
	aa. ? One pair of incisors only above; a trunk.	
Dinotherium.		

V. No canines; two pairs of cutting incisors.

	a. Three true molars.	
Rodentia.		* *
	aa. Four true molars.	
* *		*Rhizophaga.*

The parallels are in this case very imperfect in details, and but few worthy of the name can be made. They are, however, illustrative of a remote heterology, sufficiently remarkable to have claimed the notice of naturalists for many years.* I also have little doubt but that future palæontological discoveries will increase the number of parallels, but bring to light truly heterologous generic terms of the Marsupial series. Predictions of this kind have been on many occasions fulfilled (*e. g.*, some of D'Orbigny's among the Cephalopoda), and I look with confidence to the ultimate demonstration of that heterology here, which has been already seen in the Batrachia and Reptilia.

The homologous groups of the Catarrhine and Platyrrhine Quadrumana are measured as follows:

	Catarrhini.	*Platyrrhini.*
Tailless.	Andropithecus.	*
	Simia.	*
	Hylobates.	*
Tail short.	Cynocephalus.	*
	Macacus.	Brachyurus.
Long tail.		
Thumb developed.		
	Cercopithecus.	Lagothrix.
		Mycetes.
Thumb rudimental.		
	Semnopithecus.	Brachyteles.
Thumb none.		
	Colobus.	Ateles.

I append two homologous series, represented by the Nautilea and the Ammonites of the Tetrabranchiate Cephalopoda, which are distinguished, the first by the simple septa and the siphon central or marginal ventral; and the second by the complex and folded septa and siphon central or marginal dorsal. The parallelisms have been noted by Barrande, Bronn, and many conchologists, who can furnish a much more full table than the following, from the most recent sources:

NAUTILI.		AMMONITES.
	A. The shell straight, unwound.	
Orthoceras.		Baculites.
	B. The shell more or less curved or wound.	
	α. Simply curved.	
Cyrtoceras, Phragmoceras,		Toxoceras.
	αα. A more or less straight portion, folded on the remainder.	
	β. Folded portion in close contact with remainder.	

* We owe very many observations on the Marsupials to Owen.

Ascoceras.		Ptychoceras.
	$\beta\beta$. Folded portions not in contact.	
?	?	Hamites.
	$\alpha\alpha\alpha$. One extremity spirally wound, the volutions not in contact.	
	β. Extremity of the shell prolonged beyond the wound portion.	
Lituites.		Ancyloceras.
	$\beta\beta$. Extremity not prolonged in a line.	
	γ. The spiral flat.	
Gyroceras.		Crioceras.
	$\gamma\gamma$. The spiral elevated (heliciform).	
Trochocerus.		Turrilites.
	$\alpha\alpha\alpha\alpha$. Spiral turns of the shell in contact.	
	β. Extremity prolonged in line beyond the spiral.	
*	*	Scaphites.
	$\beta\beta$. Extremity not prolonged beyond spiral.	
Nautilus.		Ammonites.

We may now consider the question of the origin of these higher groups. In the first place, we must lay down the proposition *that the characters which constitute groups "higher" in the comparison of rank* (we do not of course mean higher in the same line, as we say higher genus in a family, or higher order in a class) *are such solely from their being more comprehensive, or present throughout a greater range of species.*

What is true, therefore, in respect to characters of genera, is likely to be true in respect to characters of higher groups, such as we have been considering in the preceding pages. Believing, then, that a new genus has been established by the transition of a number of species of a preceding genus in order, without necessary loss of specific characters, I think the same process may have established the suborders and orders in question. That is, *that a large number of genera have near the same time, in past or present geological history, passed into another suborder or order by the assumption or loss of the character or characters of that to which they were transferred, and that without necessary loss of their generic characters.*

I will cite a probable case of this kind, the facts of which I have already adduced.

It has already been shown that the genera of six of the families of the Batrachia Anura form series characterized by the successive stages of ossification of the skull, terminating in a dermoössified condition, with over-roofed temporal fossæ. That in nearly all the other families similar relations between genera exist, but are nowhere carried so far. The character attained by all the first series is now only generic, but should all the genera of each of the six families assume this character in time, as is necessary in accordance with a development hypothesis, it would at once possess a new and higher importance, and would become ordinal or otherwise superior. It would define a series homologous with all those types which had not attained it. This character of the over-roofing of the temporal fossæ has actually attained a family significance among the Testudinata,—*e. g.*, as defining the marine turtles; and similar characters are found by Owen to characterize the Labyrinthodontian order of Batrachia.*

Agassiz has pointed out a similar and more extended case, in the Heterocercal and Homocercal ganoids. Had we not so many of the closest approximations between members of these groups, they would stand in the systems

*The roof here alluded to by Owen includes some two distinct bones not known in the arch of the Anura, and therefore different. It is, however, enough to know that this structure is serially associated with its absence and rudimental appearance in the tailed Batrachia of the present day, to make the comparison apposite.

as two great homologous series, with their contained heterologous genera. As it is, these heterologous terms or genera are evidently so nearly allied that Agassiz, in the Poissons Fossiles, has thought it best to arrange the latter together, thus instituting a system *transverse*, as it were, to the other. This may be necessary, since Kölliker points out transitional forms, and perhaps certain types may have begun to abandon the heterocercal form near the period of reproduction, producing offspring somewhat protean in character, preparatory to an earlier appearance and consequent permanence of the homocercal type. This is to be derived from the history of the metamorphosis of Amblystoma.

In the same manner the development of the convolutions of the brain does not define groups of the highest rank, since it progresses chiefly during the later periods of embryonic life, and is therefore a "developmental character." Owen has endeavored to distinguish the primary divisions of Mammalia by the character of these convolutions, whereas they really define only the subgroups of the orders. For we have Lissencephalous (smooth-brained) monkeys,—certain lemurs,—and smooth-brained Ruminants,—*i. e.*, the extinct Brachyodon and Anoplotherium, according to Lartet and Gratiolet. (The lowest types of the existing smooth-brained Mammalia, including especially those with no or rudimental corpus callosum, the Marsupials, are also distinguished by the non-developement of the deciduous teeth* (excepting one premolar). If now through some topographical change the whole series of Mammalia between the smooth-brained and convolute-brained were lost to us, as by the elevation of a region, and the absence of favorable localities or bodies of water for the preservation of their remains, we would have to study two homologous groups, with the heterologous terms of each corresponding with each other, as do now the genera of the Clamatores and Oscines, of the Arcifera and Raniformia, etc.

In the same way the characters defining Implacental Mammalia will be found transitional in some type, and this great series, homologous with the Placentals, will have to be placed in closer connection, in its genera, with the series of the latter, with genera of the same, perhaps now extinct.

γ. *Of mimetic analogy.*

It has been often remarked that the animals of the Equatorial Ethiopian region were very generally of smoky and black colors. This is remarkably the case, and the peculiarity of the genus Homo in this respect is shared by birds, reptiles and fishes in a remarkable degree. This cannot be traced to the effect of torrid climate, for the same latitudes in India and the Malaysian Archipelago, and in South America, do not produce such colors.

The similarity in color of desert types has also been remarked. The grey sand-hue so well adapted for concealment is universal, with few variations, in the reptiles of the Tartar and Arabian deserts, the great Sahara, and the sands of Arizona and California. There is also a tendency to produce spiny forms in such places; witness the Stellios and Uromastix and Cerastes of the Sahara, the Phrynosomas and horned rattlesnake of south-western America. The vegetation of every order, we are also informed, is in these situations extremely liable to produce spines and thorns.

The serpents of the Neotropical Region furnish remarkable illustrations of mimetic analogy. All the species of the genera Elaps, Pliocercus, Oxyrrhopus, Erythrolamprus, and many of those of Ophibolus and Rhabdosoma are ornamented with black and yellow rings on a crimson ground. The species of all these genera are harmless, except in the case of Elaps, which is venomous. We may give for this genus, as the most varied, the following range of variation in coloration:

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* This I have inadvertently alluded to (p.) as the non-development of the permanent series; the homology of the dental system of Marsupials appears, however, to be with the latter, and not with the milk series. See Flower, Trans. Roy. Soc. 1867.

Pairs of black rings;	*Single black rings, far apart*	*Single black rings, very close*
	Elaps corrallinus. b	Elaps mipartitus. d
	nigrocinctus. c	
	Pliocercus equalis. c	Pliocercus euryzonus. d
Opheomorphus mimus. d		
	Oxyrrhopus ?	Oxyrhopus petolarius. d
Erythrolamprus venustissimus. a	Erythrolamprus albostolatus. b	Scolecophis zonatus. a
Ophibolus polyzonus. a		Leptognathus anthracops. a
Xenodon bicinctus. b		

Single black rings with faint laterals.	*Black rings in threes.*	*Single black rings about equal to intervals.*
Elaps fulvius.	Elaps lemniscatus. b	Elaps.
elegans. a		Pliocercus dimidiatus. a
Pliocercus elapoides. a		Catostoma semidoliatum. a
	Oxyrrhopus trigeminus. b	Oxyrrhopus sebæ. d
		Ophibolus pyrrhomelas. h
		Chionactis occipitale. h
		Sonora semiannulata. h
		Contia isozona. h
		Chilomeniscus ephippicus. h

Species a, from Mexico and Central America.
" b, " Brazil, Venezuela.
" c, " Central America.
" d, " western side of Andes.
" h, " Arizona and Sonora.

Many of the species in the same column are exceedingly similar, and some have little (perhaps nothing) to distinguish them but generic characters. The most similar are almost always from the same sub-region.

Similar analogies have been pointed out by Bates among the Lepidoptera of Brazil, and by Wallace among those of Borneo and Celebes, etc. I call attention to these authors here without copying them, as they will repay perusal in the originals.

A case of analogy which may belong to this class is that of the three genera Chelys among tortoises, Pipa among frogs, and Aspredo among Siluroid fishes, species of which inhabit at the same time the rivers of Guiana. The crania of these genera are similarly excessively flattened and furnished with dermal appendages, and their eyes are very minute. The singular similarity need only be mentioned to those familiar with these genera, to be recognized.

The bearing of the Mimetic analogy on the question of transition of types in the developmental hypothesis, is its demonstration of the independence of generic and specific characters of each other, which may suggest the possibility of the former being modified without affecting the latter.

These facts might have been introduced under Sect. IIα, but they illustrate the general laws of the present section.

IV. *Of natural selection.*

α. *As affecting ordinal and class characters.*

The second law which may be supposed to have governed a descent with modification, in the production of existing genera, is the force which the will of the animal applies to its body, in the search for means of subsistence and protection from injuries, gradually producing those features which are evidently adaptive in their nature. This is part of the "natural selection" of Darwin.

That this law is subordinate to the one first propounded must, I think, be evident to any one who studies the assumed results of the workings of both, as seen in the characters of genera. It is sufficiently well known that the essential features of a majority of genera are not adaptive in their natures, and that those of many others are so slightly so as to offer little ground for the supposition that the necessity has produced them.

Both laws must be subordinate to that unknown force which determines the direction of the great series. If a series of suppressions of the nervous and circulatory systems of beings of common birth produced the "synthetic" predecessors of the classes of vertebrata, the direction towards which the highest advanced, or its ultimate type, can be only ascribed as yet to the divine fiat. So far as we can see, there is no reason or law to produce a preference for this direction above any other direction.

If from these fixed bases descendants have attained to successive stations on the same line of progress, in subordinate features of the nervous and circulatory systems, constituting the "synthetic" predecessors of the orders in each class, the type finally reached seems to rest on no other basis than the pleasure of the Almighty.

β. As affecting family characters.

If from the single species generalizing a modern order we attempt to deduce synthetic predecessors of existing families, we find some difficulty, if we attempt to see in these stages a uniform succession of progress. A suppression of some features, and advance in others, in one and the same individual up to the period of reproduction, would produce offspring divergent from the start, and represent the relationship of families as we find them.

γ. As affecting generic characters.

If the extremes of our series of genera were characterized by structures particularly adapting them above all others to some cotemporary necessity of existence, this second law, or Darwin's, might be regarded as primary. But the writer's experience of comparative anatomy has led him to believe that this is not the case, as expressed in Proposition IV.

This view has not been overlooked by Darwin, who, however, treats of it very briefly, and appears to attach it to the theory of adaptations, or modifications for a physiological purpose. He says, Origin of Species, 388 (Amer. Edit. 1860): "We may extend this view to whole families, or even classes. The fore-limbs which served as legs in the parent species may become, by a long course of modification, adapted in one descendant to act as hands, in another as paddles, in another as wings; and on the above two principles,—namely, of each successive modification supervening at a rather later age, and being inherited at a correspondingly late age,—the fore-limbs in the embryos of the several descendants of the parent species will still resemble each other closely, for they will not have been modified. But in each individual new species the embryonic fore-limbs will differ greatly from the fore-limbs in the mature animal; the limbs in the latter having undergone much modification at a rather late period of life, and having thus been converted into hands, paddles or wings." He then inclines to assign this change to the necessity of external circumstance. But such modification must be the same in kind as others, which the same hypothesis must explain, and of which the same author remarks (p. 382): "We cannot, for instance, suppose that in the embryos of the Vertebrata the peculiar loop-like course of the arteries near the branchial slits are related to similar conditions in the young mammal, which is nourished in the womb of its mother, in the egg of the bird which is hatched in a nest, and in the spawn of a frog under water. We have no more reason to believe in such a relation than we have to believe that the same bones in the hand of a man, wing of a bat, and fin of a porpoise, are related to similar conditions of life. No one will suppose that the stripes on the whelp of the lion, or the spots on the young blackbird, are of any use to these animals, or related to the conditions to which they are exposed."

The law of natural selection, however, has no doubt been a very important agency in the production of organic types in different periods of the world's history, but the part it has played in the determination of generic features would appear to have been very small.

In its first effect,—that of producing a structure adapted for a particular purpose,—it would seem to have acted differently to produce the same results, and hence not to have produced any of the more extended groups, as families, where hundreds of species are identical in a single feature. Witness the differences in diverse types of the tree-frogs, each type adapting its possessor to an arboreal life:

I. Claw-like, with globular base..........	HYLIDÆ.
	Leptopelis.
II. Simple, obtuse-depressed at tip...................	RANIDÆ. I *aa* and III *a*.
III. With a terminal transverse limb..................	RANIDÆ, *Hylarana* et aff.
	Callula.
	Brachymerus.
	Hylodes.
IV. Bifurcate........	*Batrachyla.*
	Dendrobates.
	Polypedates.
	Rhacophorus.

The short foot of the Testudinidæ, where one row of phalanges is omitted, has been already alluded to. The gradual reduction of this set of bones, accompanying general modification of form in the increased convexity of dorsal region, as we leave the more aquatic and progress towards the terrestrial tortoises, would seem to be intimately connected with difference of habit. The increased convexity of carapace is an increased defence from falling objects,—a danger to which land tortoises are far more subject than the aquatic. Another protection not needed by water tortoises so much as by terrestrial, is the faculty of closing one or both free lobes of the plastron, as seen in the Cistudo, Sternothærus, etc., or of portions of the carapace, as in Pixys, Cinixys, etc. This might really have been produced by excessive tension on the sternal and pelvic muscles while young, and while the sutures were not fully interlocked. This, continued for a long time, might have produced the result. Yet it is not easy to see what protection the aquatic Uronyx and Platythyræ need in this respect, above the Emydes of the same countries. The backs of these genera are also as convex as are many of the terrestrial genera or Testudinidæ.

I cannot better express my views than by quoting the following from the pen of the late Dr. Falconer. It is extracted from one of his essays on the Elephantidæ.*

"Each instance, however different from another, can be shown to be a term of some series of continued fractions. When this is coupled with the geometrical law governing the evolution of form, so manifest in shells of the Mollusca, it is difficult to believe that there is not in nature a deeper seated and innate principle, to the operation of which natural selection is merely an adjunct.

"The whole range of the mammalia, fossil and recent, cannot furnish a species, which has had a wider geographical distribution, and, at the same time, passed through a longer term of time and through more extreme changes of climatal conditions than the mammoth.

*See writings of Hugh Falconer, vol. ii. (Ed. by Murchison.)

"If species are so unstable and so susceptible of mutation through such influences, why does that extinct form stand out so signally a monument of stability? By his admirable researches and earnest writings, Darwin has, beyond all his cotemporaries, given an impulse to the philosophical investigation of the most backward and obscure branch of the biological sciences of his day; he has laid the foundation of a great edifice; but he need not be surprised if, in the progress of erection, the superstructure is altered by his successors, like the Duomo of Milan, from the Roman to a different style of architecture.

"The inferences which I draw from these facts are not opposed to one of the leading propositions of Darwin's theory.

"With him I have no faith in the opinion that the mammoth and other extinct elephants made their appearance suddenly, after the type in which their fossil remains are presented to us. The most rational view seems to be, that they are in some shape the modified descendants of earlier progenitors. But if the asserted facts be correct, they seem clearly to indicate that the older elephants of Europe, such as E. meridionalis and E. antiquus, were not the stocks from which the later species, E. primigenius and E. africanus sprung, and that we must look elsewhere for their origin. The nearest affinity, and that a very close one, of the European E. meridionalis, is with the miocene E. (Loxod.) planifrons of India, and of E. primigenius with the existing Indian species.

"Another reflection is equally strong in my mind, that the species by 'natural selection,' or a process of variation, from external influences, are inadequate to account for the phenomena. The law of Phyllotaxis, which governs the evolution of leaves around the axis of a plant, is nearly as constant in its manifestation as any of the physical laws connected with the material world."

δ. As affecting specific characters.

As I have hitherto attempted to prove, that the higher grade of groups, or, in other words, the higher grade of characters, could not have had their origin through natural selection alone, though admitting it as a conserving or restricting principle, I now come to ground where natural selection must be allowed full sway. The "origin of species" is not the object of this essay, as a greater has gone before me, and has done a great deal towards showing that a selective power, dependent on adaptation and teleological relation, has favored or repressed, or even called into existence, the varied peculiarities that characterize species and races. I will therefore only refer to his well known works on the Origin of Species and the Modifications of Animals under Domestication.

I may add that it is within the range of possibility that that grade or kind of characters found to define the *family* group, may be more or less the result of natural selection.

Acceleration and retardation is also far from excluded from the probable causes of specific characters. The species of many genera do exhibit a proportion of characters which are the successive stages of that one which progresses farthest, as the species of Amblystoma in the position of their teeth, nostrils, form of tail and coloration; of Hyla in form of vomerine teeth, etc. But the majority of specific characters are of divergent origin,—are "morphic" as distinguished from developmental.

ε. On metaphysical species.

One of the arguments employed against the developmental hypothesis in any form, is that that inherent "potentiality" which causes that like shall always produce like, is a metaphysical being, which cannot be transformed, and which holds the structure which it vivifies as a material expression or stamp of itself, and which therefore cannot be changed.

One expression of this inherent metaphysical specific individuality, if the term may be allowed, has been said to be the peculiar traits of the intelligence of species, their motions, voices and instincts. But intelligence of all animals is susceptible of impressions, the lower the intelligence the less susceptible, and the more automatic. But as we rise in the scale of animal being this impressibility and capacity for education is undeniably exhibited by the dog, horse and all the well known domesticated companions of man. There can, in view of the capacities of Aves and Mammalia in these respects, be little doubt that all animals are educated by the "logic of events," that their intelligence, impressed by changed circumstances, can accommodate itself more or less to them, and that there is nothing in this part of their being opposed to the principle of "descent with modification."

There is another difficulty in the way of accepting metaphysical peculiarity or progenitiveness as isolating species. It is marked often strongly in races or varieties, which no one pretends to have had distinct origin. Here like produces like continually, though not persistently, but sufficiently to show that it resides in varieties of common origin. The isolation of allied species in fact depends, we believe, solely on the supremacy of the automatic over the intelligent spirit. When the intelligent rises above the bounds of nature, or the automatic, the mixture or separation of allied species depends merely on circumstances of necessity, determined by that intelligence.

But the metaphysical "potentiality" loses all basis, if the law of acceleration and retardation be true, for in accordance with it, in the fullness of times *like does not produce like.*

V. *Of Epochal Relations, or those measuring Geologic Time.*

If it can be shown that groups having the developmental relation above insisted on are cotemporaries, and if it can be shown that this relation is identical in kind with that which we regard as measuring the successions of geologic time, we will be led to doubt the existence of any very great interruptions in the course of this succession throughout geologic time. And if we can show that faunæ so related are more or less characteristic of distinct portions of the earth's surface, at the present time, we will be led to anticipate that cotemporaneous faunæ in different regions, during geologic periods, also bore such a relation. If this proposition be true, we are led to the further conclusion, which is at variance with received canons, that identity of faunæ proves successional relation in time, instead of synchronism.* That this will ultimately be demonstrated appears highly probable to the writer, though, as yet, the evidence is but fragmentary.

If the relations expressed under the terms homology and heterology, taken together with the observations on metamorphosis, render it probable that a number of genera have reached their *expression points*, or periods of metamorphosis, at near the same time in geologic history, an important point has been gained. If we can render it probable that a change in any organic character has been nearly simultaneous throughout a large extent of specific forms, the change becomes, on the latter account alone, of higher than generic value, but characteristic of such groups as Marsupialia, Clamatores, Acrodonta, Arcifera, Heterocerca and the like.

We have here, also, an important element in the estimation of the value of apparent interruptions in the geological history of the life of the globe. These interruptions, it is true, are greater than any such theory as the present can bridge over; yet such a theory, if true, lessens their importance. They are in any case well accounted for on the theory of the existence of periods of elevation, during which the life of a given region is necessarily almost entirely lost to us, through lack of means of preservation of their remains.

*This view was first propounded by —— and has since been reaffirmed by Huxley.

We may also compare such extended metamorphoses with those of cosm ica matter, such as when, in the course of ages, a primæval vapor has in a short time collapsed to the liquid form, or as when the vast of liquid in turn has shrunk to its solid condition; both alike for ages approaching their change, yet stationary in external relations till the moment of transition has arrived.

The following are the zoölogical relations of the groups already compared :

The most generalized group of fishes of the Regio Neotropica is that of Characins. Its type, in respect to fin structure, which is common to all the Malacopterygians, is that of an undeveloped stage of the Acanthopterygians, the adipose fin being an undeveloped cartilaginous fin and the cartilaginous fin an undeveloped spinous fin.* It may be said to be the highest among Malacopterygians if we look to the complete oviducts, opercula, jaws, etc., but it is the lowest as removed farthest from the extreme of Malacopterygian peculiarities, as being most generalized or embracing representatives of all the rest, and approaching nearest the types of the past—the Ganoids. For example, Butyrinus and Vastres may be compared with Amia. The family is distributed chiefly in the Southern Hemisphere.

The genus Orestias, which Agassiz says is characterized by a feature which exists in the immature state of all other Cyprinodonts,—the absence of ventral fins,—is only found in the Neotropical region.

Of the venomous serpents, the inferior group, the Proteroglypha, belong to the Southern Hemisphere, and the Australian and Neotropical regions almost exclusively embrace by far the greater proportion. Australia contains none other.

The Iguanian lizards are lower than the Acrodont, exhibiting a larval type of dentition, and one characteristic of all lower Sauria and Batrachia. The only acrodont type of Ophiosaura (Trogonophis) is Old World.

The New World Teidæ have not the extent of ossified temporal roof that their representatives, the Old World Lacertidæ have. So the chiefly Neotropical Anguidæ have the tongue partly of papillose type of their Old World representatives, the Zonuridæ, and partly the smooth or scaly type of the cosmopolite Scincidæ, which are inferior to them.

The snake-like forms of the families of the Lacertilia Leptoglossa greatly predominate in the Southern Hemisphere; also those with undeveloped palpebræ.

The Neotropical type of Testudinata is quite coincident with the family Characinidæ in relations. It is, like it, largely distributed over the Southern Hemisphere, and like it may be regarded, in respect to its pelvic pecularities, as higher than the remaining types, but in its generalized character and relationship to the past periods may be called lower.

The Neotropical type of Batrachia Anura, that is the Arcifera, is lower in developmental characters than the opposed series, the Raniformia; such of the latter as are found in its limits partake in some way of larval incompleteness. The Arcifera are chiefly distributed elsewhere in Australia, where no Raniformia exist.† Those genera of Old World Raniformia of the lowest or toothless group, which display the least development of the cranial bones, as Brachymerus and Breviceps, are of the Southern Hemisphere—South African.

The Pullastrine birds are a generalized group, inferior to the group op-

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* Kner Ueber den Bau der Flossen.

† The *Eucnemis bicolor* Gray would appear to be an exception, were its generic and subordinate affinities truly represented by its name. I have examined the type specimen through the kindness of Dr. Gunther, and can state that it is nor an Ixalus (= *Eucnemis*), and does not even belong to the Raniformia, but is an Arcifer of the family Hylidæ. If it be not a young Calamita or Hyla, it will be a Hylella near the H. carnea type.

Günther states that Hylorana erythraea has been found at the extreme northern point—Cape York—of Australia. If so, the case is parallel to the occurrence of the Raniform Ranula in northern South America.

posed to them—the Gallinæ. Their typical forms, like the last, are distributed to the Neotropical and Australian regions: the outliers (pigeons) are not so numerously distributed in the other regions.

The Struthious birds, the most synthetic of the class, belong exclusively to the Southern Hemisphere; as is well known, they chiefly abound in Australia and its adjacent islands, with an abundant outlying type—the Tinamus—in South America.

The penguins, which only of all birds display the divided metatarsus, inhabit the Antarctic regions and Cape Horn.

The Clamatorial type of the Passeres exhibit larval characters in the non-developmeht of the singing apparatus, and the scaled or nearly naked tarso-metatarsus. These are chiefly South American.

Of Mammalia, the placentals without enamel on their teeth, which, in this respect, never reach the full development of the class, whose dentition is also monophyodont, *i. e.*, the Edentata, inhabit only the Southern Hemisphere, and almost altogether the Neotropical region. The implacental Mammalia, also (except in one tooth) monophyodont, which approach birds and reptiles in so many respects, are confined to the Southern Hemisphere, and chiefly, as all know, to Australia.

Of the Quadrumana, the Platyrrhine group is known to be inferior to the Catarrhines: the farmer presents an entirely embryonic condition of the *os tympanicum*, which is passed by the latter in early age;* it contains also the only clawed genus of the true monkeys. It is confined to the Neotropical. To Madagascar, also of the Southern Hemisphere, and nearest in many ways to the Neotropical, pertain the lowest families of the Quadrumana, the Lemuridæ and Chiromyidæ; the former presenting brains without convolutions, and approaching in many ways the Insectivora; the last imitating, at least, a Rodent.

There are also other reasons for the inferiority of South America. Its deer, which are few, are those which never produce more than the "dague," or the first horn of the northern Cervus, or those which never get beyond the fourth step in the development of the lower group of R. Nearctica.

The Loricariidæ of South America, I am informed by Prof. Agassiz, possess the fœtal pupil of the vertebrate type.

If we glance at Coleoptera we find the great predominance of the groups with undeveloped tarsus, the three and four-jointed Trimera and Tetramera, and of the lower group with undeveloped sternum,† the Rhynchophora, in the Neotropical region.

Among Lepidoptera it is known that the most gigantic of the species of the Neotropical region are Noctuidæ (Erebus, etc.), and that in that region this low type of the order reaches its greatest development. The largest forms of the Regio Nearctica, as well as Palæarctica, are representatives of the higher type of the Saturniidæ (Attacus, Telea, etc.), while the largest and most powerful of this order in the Palæotropical (Indian) region are the Papilionid forms of Ornithoptera, etc., the generally admitted crown and head of all. Of course other types, both higher and lower, are largely developed in each and all of these regions, and the significance of the above facts is perhaps only to be seen when taken in connection with a large number of others pointing in the same direction.

Two or three comparisons of different faunæ may be brought forward finally. First, returning to the birds, a survey of some of the differences between the birds of Panama, Pennsylvania and Palestine may be made.‡

Tristram noticed 322 species of birds within the range of the ancient terri-

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* See Dr. H. Allen, Proceed. A. N. S., Philada., 1867.

† Leconte American Association, 1867.

‡ From the American Naturalist, 1868, by the author.

tory of Palestine. Of these 230 were land and 92 water birds, *i. e.*, Natatores and the wading Cursores. Of the 230, 79 are common to the British Islands, and 36 of them are found in China, but a small proportion extending their range to both these extremes. Of the water birds, which are always more widely distributed, 55 of the 92 are British and 57 Chinese. Twenty-seven appear to be confined to Palestine and to the immediately adjacent country; the largest of these is a crow.

Taking the 230 land birds at a glance, we find the utter absence of so many of the well known forms that enliven our grounds and forests. The absence of Tanagridæ and Icteridæ changes the aspect of the bird-fauna at once. What have we here then of nine-quilled Oscines to enliven the meadows like our swarms of blackbirds, or fill the tree tops and thickets with flutter like our wood warblers? Nothing; for the twenty-four species of finches, Fringillidæ, will but balance our own, though the genera are all different but four, and they the most weakly represented by species. We must look to the higher series, the ten-quilled song birds, for the missing rank and file. While a much larger extent of the Eastern United States possesses fifty species of these types, the little Palestine has already furnished a list of one hundred and twenty-eight.

First, of the crows, which verge nearest Icteridæ by the starlings, we have 13 species against five in our district of the United States, and not less than seven of the type genus Corvus, to our one common and two rare. Of these, two are of the larger species, the ravens. If we turn to the cheerful larks, we find the proportion again the same; fifteen species for Palestine and one for the whole United States. One congener of our species occurs there; the other genera call to mind the African Deserts and Russian Steppes. Motacillidæ, again, ten to one against our fauna. *We* have two Tanagridæ to imitate them, beside the true relative. In swallows we are about equal, and in the forest-haunting Paridæ—titmice and wrens—we exceed a little; but the comparison of Sylviidæ and Turdidæ is most striking. These highest of the bird series, especially made to gladden man's haunts with song, exceed in number all the other ten-quilled Oscines together inhabiting Palestine, amounting to seventy-five species. In our corresponding region of the United States nineteen species is the quantum. It is true no mocking bird or wood-robin is known away from our shores, but Palestine has the nightingale, the black-cap and the true warblers or sylvias, which, while they glean from shrub and tree their smallest insect enemies, as do our equally numerous small Tanagridæ, have much louder and sweeter voices.

Our solitary blue-bird represents the long-winged Turdidæ; in the Holy Land there are twenty species corresponding, though none are of our genus. There are indeed but three genera of these two families common to both countries. One of these, Lanius, the butcher-bird, occurs here in one new species, in Palestine in six.

Turning now to a lower series, we look in vain for Clamatorial perchers; that series which gives us the fierce king-bird and querulous pewee, and which peoples South America with thrush and warbler, and shrike and tree-creeper.

In taking a hasty glance over the lower groups, where the carotid arteries begin to be double, as the Syndactyli, we find Palestine too far from the tropics to present us with much array; but in the related zygodactyles our forest-crowned continent must claim great preëminence. It has but a solitary Picus, while we have eight in the immediate neighborhood of lat. 40°, in our Eastern States.

I will close with the birds of prey. Four swamp-hawks, eleven species of falcons, four kites, and eight native eagles, form a list unequalled in the annals of nobility by any land. There are together thirty-one species of Falconidæ, and of Vultures, four. The eagles appear to be all common, among them the most magnificent birds of prey, the imperial and golden species of these creatures.

To the ornithologist acquainted with the fauna of North America, it will thus be readily perceived that, in comparison, the ornis, just examined, possesses more numerous representatives of the higher groups of the birds, and among lower groups possesses chiefly those of superior grade, or lacks them altogether. Let us, however, compare it with that of Central America, where varied surface and temperature offer even greater opportunity for variety. within quite as restricted an area.

The bird fauna has been found by Messrs. Sclater and Salvin to embrace about 385 species, which is 63 more than were mentioned to occur in Palestine, which is open on three sides to the great contnient. Eighty of 348 land birds are characteristic of Central America; and those which find their kin limited to the Isthmus and adjoining regions of New Grenada and Equador, amount to about seventy-five more. Twenty-seven is the number not known to extend beyond the boundaries of Palestine; as to the Middle States of our Union, not one species has been shown to be restricted within such narrow limits.

A single species occurs in Europe; this is the fish-hawk, an animal which combines the cosmopolite habit of the sea-bird with the powerful flight of the bird of prey. This is also the only species common to the Panama and Palestine catalogues.

The birds of prey are numerous,—twenty-nine species. Among these there is no true eagle or falcon, and of the nineteen genera but four belong to the fauna of the Holy Land. There is but one species to represent the great grouse family, but, instead, three *families* of their South American imitators, the Pullastræ, instead of the one—that of the Pigeons—slimly represented in Palestine, and in North America as well.

Coming to the closer test of superiority, the Passeres,—those delicate creatures, apparently so dependent on those laws which govern increase and provision, and so affected by the changes that man works in the face of nature,—what do we find? We count 106 distinct species. There are none in Palestine. Of songsters, the Oscines, ninety-six species await man's conquest of the wilderness, to increase in numbers and to display their gifts, while Palestine rejoices in a whole army of them. But the contrast is more remarkable if we analyze these forms. Of the Isthmian Oscines, seventeen only hold the first rank, by virtue of their additional, the tenth primar quill, while this feature marks one hundred and twenty-eight species of Palestine. As we rapidly follow the line to the point where its extreme is manifested, in the family of the Thrushes or Turdidæ, Panama is left but two solitary pioneers of these songsters of the North, while seventy-five species represent the family in Palestine.

The comparison between different faunæ exhibits an apparent gradation in some other groups equally curious. Thus the true Cyprinidæ in the Palæarctic region reach a great development, and produce the highest number of teeth on their pharyngeal jaws known, as well as attains the greatest bulk and importance. The number of these teeth is usually seven to five in the inner row; only two or three genera exhibit only four on both. In the Nearctic region the number of teeth is almost always 4—4, more rarely 4—5, and very seldom as high as 5—5. The species of the family are excessively numerous, but are, with scarcely any exception, of small size and weak organism. These statements apply to those of the eastern district of the region between the Rocky Mountains and the Atlantic. Similar types occur in the northern region of the Neotropical,—Mexico, but in no great numbers, but with them the lowest form of the family,—viz., Graödus Günther. This form has no teeth whatever on the pharyngeal jaws. Further south the family disappears, its place being supplied by the generalized family of Characinidæ.

I have already alluded to the great variety of the highest or pentamerous carnivorous beetles in the Palæarctic Region. They are extremely abundant in the Nearctic, while the intermediate territory, the Sonoran and Mexican sub-districts, are the head-quarters of the next lower form, the Tenebrionidæ, which have the tarsal joints 4—5. These give place in the Neotropical to the multitudes of the still lower series,—those with the joints 4—4 and 3—3,—Tetramera and Trimera.

The preceding comparisons indicate that an inherent difference between the types of a continent exists at the present time, though the difference is subordinated to a universal distribution of the higher groups throughout the earth. Has this state of things existed for any long period, or is it a result of different progress in the same group since the human period? This brings us necessarily to a consideration of the truths of palæontology, especially of the last periods, which have been already urged by Darwin. Thus the present fauna of Australia was preceded in the postpliocene and pliocene by forms possessing similar peculiarities, and belonging to the same classes. That is by herbivorous and carnivorous marsupials and monotremes, and by Varanid Sauria, all of greater size than their predecessors.

The same fact is well known of the Neotropical region, its present peculiar Edentata having been preceded by giants of the same type in the postpliocene and pliocene.

In the Nearctic region peculiar existing genera, as Procyon, Alces, Castor. Bos, Sciurus, Arctomys, Lepus, Ovibos, Sorex, Mephitis, Felis, Ursus, Menopoma, Aspidonectes, Crotalus, are represented by postpliocene fossils.

The same occurs in the later Palæarctic formations, where Cervus, Bos, Canis, Mustelidæ, Insectivora, Vipera, Alytes, Triton, etc., are allied predecessors of existing types. In the Palæotropical area a wonderful development of Elephas and Gavialis preceded the same types of the present.

Prior to these faunæ another state of things has, however, existed. North America has witnessed a withdrawal of a Neotropical fauna, and the Palæarctic the retreat of an Ethiopian type. During the postpliocene in North America, Neotropical genera were to Nearctic as 12 to 29, as the record now stands. In the pliocene beds of Pikermi (Greece) antelopes, giraffes, rhinoceros, hippopotamus, huge manis,* monkeys, monitors, and other genera and species of African relationship are the prevailing forms.

Still earlier, a strong mingling of Nearctic, and more of Neotropical types, abounded in the Palæarctic. The genera Chelydra, Andrias, Podocnemis,† Platemys, Caviiform, Psammoryctid and Hesperomys-like Rodentia, Opossums, and Raccoon-like Carnivora.

We have, then, three important terms from which to derive a theory of the creation: 1, the existing six faunæ bear in many of their parts developmental relations to one another; 2, they were preceded immediately by faunæ similar to them in each case, but more remotely by faunæ like that now next lower.

On the whole, there can be no doubt of the truth of the generalization, 1st. *That the Southern Hemisphere is a geologic stage behind the Northern Hemisphere in progress*, on account (1) of its perfection in types extinct in the Northern, and (2) inferiority in modern types prevalent in the Northern.

In order, however, to demonstrate this point more fully, let us examine to what extent the higher types exist in the Southern, and lower or ancient in the Northern.

The Percoid fishes and their allies have Australian and South American representatives in their fresh waters, but they are as mere outliers of the great mass in the Northern Hemisphere. The higher type of venomous serpents (Solenoglypha) occur in both the Æthiopian and Neotropical regions, but they preponderate in the Northern Hemisphere. The higher group of the

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* Ancylotherium, Macrotherium.

† P. bowerbankii (*Platemys* Ow.) P. lævis (*Emys* Owen).

Saurians (the Acrodonta) abounds in the Æthiopian and Australian regions; they are as abundant in the Indian and Palæarctic regions of the Northern Hemisphere. In the Southern also, by Uromastix and the Rhynocephalia, they approach nearest the ancient types of the Dicynodontia and the Crocodilia. Lacertidæ, and not Teidæ, occur in the Æthiopian, but they are but a proportion of the whole, which chiefly exists in the Nearctic.

Raniform and not Arciferous Anura populate South Africa; they, however, form but a small proportion compared with the great series of the Nearctic, Palæarctic and Palæotropical regions. It is, however, superior in Anura to the Nearctic, taken by itself.

Rasorial birds and not Pullastræ are the food species of South Africa; but they do not compare in abundance or size with those of the three regions just mentioned.

Moreover, but few Clamatores exist in either Australia or Æthiopia. The Oscine types are abundant, nevertheless they cannot be compared in abundance with those of the northern regions. It must also be remembered that the migratory capabilities of birds render them less expressive of the true nature of any fauna.

The higher family of the Quadrumana, the Simiidæ, replaces in Africa the Cebidæ of the Neotropical; they are, however, most abundant in the Palæotropical region, in the other hemisphere.

There are two ancient or inferior types of the Northern Hemisphere: first, its Ganoid fishes, the Sturgeons of the Nearctic and Palæarctic, and the Gars of the Nearctic. The latter only have representatives in the Southern Hemisphere, Polypterus and Calamoichthys in Africa, and so may be said to be equally distributed; but the former are confined to the north. We do not know, however, whether they are of a modern or an ancient type, nor do we know of extinct sturgeons in the Southern Hemisphere. Indeed, the Ganoid series is not well defined or known as yet. If, as Agassiz states, the Siluroids pertain to it, it is cosmopolitan, though least represented in the Palæarctic.

Second, the Tailed or Urodele Batrachia. This order, entirely characteristic of the Northern Hemisphere, is a group which combines characters of Anura with those of the ancient forms, and possesses in its Nearctic types many of low development. The Gymnophidia of the Southern Hemisphere cannot be considered inferior to them. In the possession of this group the Northern Hemisphere presents its first element of inferiority.

The preceding comparisons indicate also the relations of the regions proper to each other. It is obvious enough that the Æthiopian is much superior to the two others of the Southern Hemisphere. As to the Australian and Neotropical, the former must still be regarded as probably the most ancient, though possessing at the same time a much stronger admixture of northern forms. I have already presented the relations, with the inferior forms of each, thus:*

R. Australis.—Inferior in Monotrematous and Marsupial Mammalia, Pullastriform and Struthious Birds, Serpentiform Pleurodont Lacertilia, Arciferous Batrachia, Pleurodire Tortoises, its Elapid venomous snakes, and the whole Flora, according to Unger.

R. Neotropica.—Marsupial and Edentate Mammalia, Inferior Rodentia and Quadrumana, Pleurodire Tortoises, Pleurodont Lacertilia, Arciferous Batrachia, Clamatorial and Pullastriform Birds, Characin and Erythrinid Malacopterigii.

Conclusions.

The following may be looked upon as conclusions which have been indicated in the preceding pages:

1. Species have developed from preëxistent species by an inherent tendency

* Journ. Acad. Nat. Sci. Philada. 1866, 109.

to variation, and have been preserved in given directions and repressed in others, by the operation of the law of Natural Selection. (Darwin.)

II. Genera have been produced by a system of retardation or acceleration in the development of individuals; the former on preëstablished, the latter on preconceived lines of direction. Or, in other words, that while nature's series have been projected in accordance with the law of acceleration and retardation, they have been limited, modified, and terminated by the law of natural selection, which may itself have operated in part by the same law.

III. The processes of development of specific and generic characters have not proceeded *pari passu*, transitions of the one kind not being synchronous with transitions of the other; and that, therefore, species may be transferred from one genus to another without losing their specific characters, and genera from order to order without losing their generic characters.

IV. And as the heterologous terms of the peculiar homologous groups present an "inexact parallelism" with each other; and as types related by inexact parallelism are each among themselves exact parallels in separate series, whose earliest members present "exact parallelism" with each other, it follows—

V. That the heterologous terms or genera in the later series are modified descendants of those of the earlier series; in other words, that certain groups higher than genera are produced from others of similar high value by "descent with modification."

VI. That the result of such successional metamorphoses will be expressed in geologic history by more or less abrupt transitions, or expression points, rather than by uniformly gradual successions.

Of course, under the conclusion stated in Proposition II, the genus Homo has been developed by the modification of some preëxistent genus. All his traits which are merely functional have, as a consequence, been produced during the process. Those traits which are not functional, but spiritual, are of course amenable to a different class of laws, which belong to the province of religion.

Variations in Taxodium and Pinus.

BY THOMAS MEEHAN.

In some remarks before the Academy on July 14th, in reference to adnation in the leaves of Coniferæ, I said that the power to branch was the test of vigor; and with increased vigor came proportionately the power of adnation. I pointed out that this was the universal law through all Coniferæ, so far as I had been able to examine them; and that it fully accounted for the specific identity of many forms supposed to be distinct. I went so far as to suggest that *Taxodium distichum*, Richard, and *Glyptostrobus sinensis*, Endl., were no doubt the same thing, because the only difference between the growing plants was in the different degrees of adnation in their foliage; and because with this adnation was the increased power to branch observed in all other cases. The two points, going along together, seemed to indicate that this could not be a solitary exception to so clearly marked a law. I exhibited specimens taken from *Taxodium*, and from *Glyptostrobus*, showing the approach of the two in the manner the theory indicated.

Since then some new facts have come before me confirming this view in a remarkable manner. On the nursery grounds of Mr. Robert Buist, of the Darby Road, near Philadelphia, are a few trees which I supposed to be the *Glyptostrobus*, but which Mr. Buist assured me were many years ago, selected by him from a bed of some thousand *Taxodium* on account of their peculiar appearance. I exhibit specimens from eleven different trees. It will be seen the suppression of the leaf blades or adnation is in exact proportion to vigor, or the power of forming branchlets, and with this increased vigor the *Taxodium* become *Glyptostrobus*, so far as any comparison of leaves and branches can identify anything.

At the conclusion of my paper on the *laws of adnation*, read before the meeting of the American Association for the Advancement of Science, at Chicago, Dr. J. S. Newberry kindly pointed out that, in a fossil state, *Glyptostrobus* and *Taxodium* were often found side by side, but always with so much difference between the scales of the cones that, while assenting to the general principles of the paper, he could not regard these two plants identical. As cones are nothing more than metamorphosed stems and branches, it is not surprising that the sames laws of adnation which might operate in making the *Taxodium Glyptostrobus*, and which make them look so very distinct in the different stages of adnation, should also operate on the fruit, and make it appear, when at the widest point of divergence, as really different. It should in fact do so, and instead of the differences in the cones of these fossils being any proof of their specific distinctness, it must be received as a natural sequence of the law I would evolve.

The specimens I now exhibit show at any rate that the *two plants* are identically the same. This granted, it completely refutes the generally received theory, that no one species of Coniferæ inhabits at once the eastern and western worlds.

In my paper on variations in *Epigæa repens*, presented for publication last May, I endeavored to show that "cultivation" and "external circumstances" would not account for variations in form to the extent they usually received credit for; but that there was rather a regular principle of growth in form, as well as in substance, independent of outward agencies, which agencies were calculated quite as much to preserve as to originate the growing forms.

Those accustomed to study chiefly from herbaria, and little from living specimens, have no idea of the great variations from one type which many species present. These comparative differences are often so insensibly blended, that it is only when we meet with some very extreme forms that they attract our attention, and then only to note their extreme differences. Even when noted they are contemned as obstructing classification, rather than welcomed as invaluable aids in resolving the laws of form.

In a recent review of part 16 of *Decandolle's Prodromus*, which has lately appeared, with the Coniferæ by Prof Parlatore, the reviewer says: "It must be clear to every one that a great number of so-called species are varieties of one strain, *doubtless produced by localization in different climatal or natural conditions.*" (*Gardener's Chronicle*, page 922, 1868.) As this review is understood to be by one who is himself known as a describer of many Coniferæ, which are doubtless varieties of one strain, it may be worth while to point out, in some Coniferæ. that neither climatal nor any external condition has as much to do with variation in form as an innate power of development, independent of either climatal or local causes.

In one of our commonest pines—*Pinus inops*—a very careful comparative examination will show scarcely any two trees to be exactly alike; the habits of the tree, the shade of color, or the length of the leaves, the size or form of the cone, the scales, or the seeds—in some one point a difference may be found which can easily be described in words. When extremes are brought together the differences are quite as great as characterize different species. By descriptions alone they would be fairly entitled to rank as distinct. The mind fails to unite them. It is only the educated eye which perceives their identity. I exhibit two cones from two trees growing on the banks of the Susquehanna, near Harrisburg. One is very long and narrow—three and a half inches in length, by only three-fourths of an inch wide at the base, and the scarcely projecting scales barely spinescent, the other nearly as wide, but only half the length, and with strongly projecting scales and spines. Unless with previous acquaintance of *Pinus inops* in its natural places of growth, a botanist might well be pardoned for considering these distinct species, yet with the multitude of intermediate forms, all under the same external conditions, how can any "locatizations" account for the varieties? I have the same experience with *Pinus rigida* and *P. pungens*; and it is doubtless true of other species.

I have noted some interesting variations in *Pinus Banksiana*, which in some way do seem to be connected with location, although I have no doubt that ages of geographical travel from a central point conjoined with the principle of inheritance, might find the natural inherent laws of variation sufficient to account for them. Dr. Gray says, in the last edition of his Manual of Botany, it is a shrub or low tree 5 to 20 feet high, giving N. Maine, N. Michigan and Wisconsin, and northward as the localities. I did not collect in northern Illinois, but friends tell me it grows some thirty miles from Chicago, only as a bush. Michaux observes that in Labrador it shows signs of decrepid old age at 3 feet, and in no part of America did he find it over 10 feet. Dr. Richardson, in Franklin's narrative of a journey to the shores of the Polar Seas in 1819—1822, describes it as 40 feet high in favorable situations, but the diameter of its trunk was greater in proportion to its height than in any other pines of the country. Douglass found it to have longer leaves on the Rocky Mountains than elsewhere. In company with Mr. Wm. Canby, I had the opportunity of examining large forests of them growing on the neck of land between Escanauba. on Lake Michigan, and Marquette, on Lake Superior, where we found them just the reverse of Dr. Richardson's experience. Here they were more slender in proportion to their height, not only than any pine of the country, but probably than any pine elsewhere. Most of the trees were from 30 to 40 feet high, remarkably straight, but only from 6 to 12 inches in diameter. We roughly measured one at Escanauba which was about twenty inches in diameter, and perhaps sixty feet high, little shorter than in fact a very fine *Pinus resinosa*, about two and a half feet through, growing near it.

Now these variations have relation to only one particular, that of size; there would no doubt be found others in many respects; but even in this one character no theory of climate or soil will account for them. If a low temperature dwarfs the Labrador specimens, what is to account for the small bushes in Illinois or southern Wisconsin, in lat. 42°? And again, why are these latter in the rich soils of this district so small in comparison with the almost timber trees of a few hundred miles farther north, and in which is usually considered the poorest land of the north-west? Soil and climate may have some influence in aiding variation, but facts show the origin is deeper than these, namely, a native power to change, kept in check only by inheritance and perhaps external circumstances.

I have heretofore reported *Pinus pungens* as growing at Port Clinton; I find it now abundantly on the hills about Harrisburg; so it may be set down as native to the whole interior of the State of Pennsylvania.

Nov. 3d, 1868.

The President, DR. HAYS, in the Chair.

Forty-two members present.

The following paper was presented for publication:

Sixth Contribution to the Herpetologyof Tropical America. By Edw. D. Cope.

Dr. Leidy called attention to two singular specimens presented this evening by Mr. Lamborn.. They were obtained from the Huronian slates near the Dalles of St. Louis River, northern Minnesota. They bear a strong likeness to large coprolites partially imbedded in portions of slate. They not only have the usual form of coprolites, though flattened, but have an apparent spiral arrangement. Taken from the surface slate, the bodies, where exposed to the air have been more readily decomposed than the slate. A broken surface exhibits a more distinct crypto-crystalline appearance than exists in the slate. Suspecting that they possibly might be of the nature of coprolites, Dr. L. had desired Dr. Genth to analyze part of one. The result was carb. lime 36·5, silica and silicates 59·1, oxide of iron, alumina, etc., 4·4. Though not of vertebrate origin, they may perhaps have been the excrement of some huge invertebrate, which, with all others of the time, are now totally obliterated.

Dr. Leidy further remarked that it was well known that iridescent hues from the surfaces of bodies, independent of thin films, were usually due to aminute striation or parallelism in the arrangement of the elements of structure. Thus is produced the iridescence upon the wings of the house fly and many other insects, that of muscular and tendinous fibres, of pearl shells, artificially ruled surfaces, etc. He has repeatedly observed that the iridescence on the surface of waters was due to the same cause, through myriads of vibrios and bacteria. Under the circumstances he was surprised that authors continue to repeat that the phenomenon of the beautiful play of colors in the precious opal has not been satisfactorily explained. It is evidently due to a regular striated condition of the structure, readily observed by the microscope. The striæ upon brilliant facets examined in a number of opals appear to be about 6000 to the inch. The striæ are probably the pores to which Brewster alludes as being the cause of the coloration of the opal. The brilliancy of labradorite is also due to a regular parallelism in the arrangement of elements of structure.

Nov. 10*th.*

The President, Dr. Hays, in the Chair.

Forty-two members present.

Nov. 17*th.*

The President, Dr. Hays, in the Chair.

Twenty-five members present.

Mr. R. P. Stevens made the following remarks on the geology and mineralogy of Venezuela:

Observations made by my party extend two hundred and fifty miles up the Orinoco river from the city of Bolivar, or five hundred from its mouth, and in three directions southwards one hundred and fifty to two hundred miles. In the hydrographical basin of the Orinoco we have seen no other rock than gneiss, gneissoid schists, granite, and other crystalline rocks. The gneiss is granular and lamellar. Its minerals are magnetic iron ore, cupriferous ores, argentiferous galena, and, very sparingly, gold.

We have been able to make out two distinct systems of elevation in this basin; one running N. and S., the other W. N. W. and E. S. E. The former is a low ridge of black, shining, lamellar gneiss, forming a low divide between the Caroni river and the affluents of the Yurnary, or the line of demarcation between the hydrographical basins of the Orinoco and the Essequibo on the west.

Upon the flanks of these rocks abut the gneiss of the Imitaca Mountains, which forms the divide between these two basins on the north.

The remaining system of elevation runs N. E. and S. W., and corresponds with that of the Appalachian system of the United States.

This system is confined, so far as our observations have seen, to the basin of the Essequibo. The rocks elevated by this system are talcose, with quartz veins, quartzite, porphyry, brecciated schists, and aluminous rock of a bluish color, locally known as "bluestone."

The basin of the Essequibo is about 900 miles long N. and S., and 600 E. and W. It is the true auriferous field of Venezuela.

Fragmentary knowledge comes in from all known portions of it, showing all its mountains to be gold-bearing.

In the valley of the Mocupio, a small and insignificant tributary of the Yuruary, the greatest amount of exploration has been done. Here has been developed two systems of veins; one running N. E. and S. W., corresponding with the strike of elevation; the other E. and W., corresponding with the strike of talcose rock.

On the method of the formation of gold in the veins, the following observations have been made:

First. Showing that gold must have been placed in the veins at the same time with the quartz matrix, and that these were deposited *pari passu* on both walls of the vein.

Second. Observations show that gold has been redisposed on fissure walls of the quartz.

Third. Observations show that gold has been mechanically mixed with the sulphuret of iron, and that these depositions were made simultaneously with the quartz.

The best known portion of the new gold fields of Yuayana are situated in the canton of Yuruary (formerly a portion of the canton of Upatee), in lat. 7° 20′ N., and long. 65° W. from Greenwich; about 100 miles south from the island of Piacoa, in the Orinoco river, and 200 miles south-east from Bolivar, over the great plains of Venezuela.

Nov. 24th.

The President, Dr. Hays, in the Chair.

Thirty-two members present.

The chairman of the Curators announced that B. Waterhouse Hawkins, F. G. S., had presented to the Academy a restored skeleton of the Hadrosaurus Foulkii, on which the following resolutions were offered and adopted:

Resolved, That the Academy entertain a deep sense of obligation to Mr. Hawkins for his valuable donation of a restored skeleton of Hadrosaurus Foulkii,—a gift which will constitute an especial attraction and a prominent object of interest in our museum.

Resolved, That the profound palæontological knowledge, artistic skill and patient industry displayed by Mr. Hawkins in reconstructing from some fragmentary remains this huge creature of a former geological period, has gained for him our respect and admiration, while his invariable courtesy and freedom in imparting knowledge has secured our highest regards.

Resolved, That the Academy fully appreciate the great value of the efforts he is making to popularize science; efforts, the importance of which cannot be too highly estimated. They will tend to benefit the community by expanding the minds of the masses, and by furnishing to them higher and more ennobling subjects for thought than can be afforded by the common pursuits of every-day life. He will also advance science by increasing the number of those who can appreciate the labors of men of science, sympathize in their labors, and secure for them objects of interest which would be thrown aside or destroyed by the ignorant.

Resolved, That the Academy tender to Mr. Hawkins its best wishes for his health, happiness and prosperity.

The following gentlemen were elected members: Wm. M. Darlington, Emil Fischer, M.D., Isaac C. Price, Jos. G. Richardson, M.D., M. W. McAllister.

Prof. H. J. Clark was elected a correspondent.

On favorable report of the Committee, the following paper was ordered to be published:

Sixth Contribution to the HERPETOLOGY of Tropical America.

BY EDWARD D. COPE, A.M.

LOXOPHOLIS RUGICEPS Cope, gen. et sp. nov.

Fam. Ecpleopodidæ. The scales imbricate, arranged in oblique rows or quincuncially; the exposed portion triangular, strongly keeled. Prefrontals, frontoparietals, parietals and interparietal plates distinct. Lateral and gular scales like dorsal; ventral broad, smooth; no gular collar, no lateral fold. Toes 5—5, all unguiculate. ? Femoral pores. Eyelid with transparent disc.

This genus differs from Cercosaura only in the squamation, which is of a character entirely different from that of any other genus of the group except Tretioscincus Cope, where the scales are also arranged after the type of the Scincidæ.

Char. specificus.—Tail moderately long, limbs well developed. Canthus rostralis a right angle, lores straight, top of head flat. Two loreals or preoculars between nasal and eye. Four superciliaries. Four supraorbitals. Internasal long as broad, prefrontals largely in contact. Frontal twice as long as broad, angulate before and behind. Fronto-parietals and the large inter-parietal longer than broad; parietals rounded externally. Labials five, long and narrow, third and fourth under orbit, with a narrow series of scales between. Inferior labials five, narrow; a large symphyseal; behind this a still larger mental, behind which follow on each side a row of three large and two small infralabials, of which the first two pairs are in contact. Temporal scales keeled. Auricular opening large, a half disc, the truncation behind. Twenty rows of lance-triangular scales on back and both sides, and four rows of smooth abdominal scales, which are broader than long. Six large præanal plates, five reaching the margin, the two outer narrow, the median short. Scales of the limbs large-keeled. No pores on the femur in the specimen. Caudal scales like those of the back of Pantodactylus,—*i. e.*, elongate parallelogrammic, in whorls and keeled; keels stronger below than above. The hind limb laid forwards will reach the wrist of the anterior when appressed. Inner fingers and toes very small; lengths of fingers 1—2—5—3—4; of toes 1—5—2—3—4.

The plates of the top of the head are rugose, with longitudinal striæ, which are not close, and more or less interrupted.

	In.	Lin.
Total length (end of tail lost)	4	5·5
Length head to vent		18 2
" " axilla		7·2
" " ear		4
" hind limb		6·6
" " foot		3·5
" fore limb		4·8

Color above yellowish-brown, with a narrow blackish band on each side from the upper margin of the meatus to near the end of the tail A median pair of bands appear near the rump, and continue half the length of the tail, but are very indistinct. The upper and lower labial plates with a continuous transverse black band through the middle of each. Throat, belly and tail below unspotted, yellow.

Habitat.—This Saurian is a native of the Magdalena River region, New Grenada, whence it was brought by Schulte Buckow, naturalist, and presented to our Museum in Philadelphia by J. Carson Brevoort. Specimens of Tretioscincus bifasciatus Dum., and Dendrobates tinctorius accompanied it.

Gerrhonotus auritus Cope, sp. nov.

This species is distinguished by its strong massive head, with a series of elongato conic flexible processes above the auricular meatus.

Muzzle flattened, canthus rostralis wanting. Each of the posterior pair of supranasals divided in two, the posterior parts on each side the rhombic internasal. Five supraoculars and five supraorbitals; other plates of the head normal; they graduate into the nuchals by three cross-rows of scales. Temples much swollen, but not angularly. Upper labials eight large and two small; lower labials nine, with two rows of infralabials; the inner of four large scales, the third largest. Side of neck and axilla coarsely granular; above the ear four long conic flexible processes, with two or three shorter below them. Scales of back and belly small for the genus, in sixteen longitudinal and twenty-six transverse series, from nape to groin. They are bony, and strongly but finely keeled. Ventral plates smooth, in 14 longitudinal rows. The lateral fold is slight, and contains about three rows of coarse granules.

The ground color is pea-green, more or less shaded with yellow; the rugosities of the scales everywhere black. Blackish green shades form indistinct Vs directed backwards on the middle of the back. Below yellowish, with dirty green shades. Eyelids and aurinular processes yellow. Length to vent 5 in.; to axilla 2 in.; to ear 21·5 l.; to orbit 4·5 l.; greatest width of head 12·5 l. Length fore limb 15·5 l.; of hind limb 20 l.; of foot 10·2 l. The tail is short (3 in. 10·2 l.), and covered with bony scales, but I am not sure it has not been early reproduced.

This, the most singular species of the genus, is only equalled in beauty by the G. gramineus m. of Mexico, which it resembles. The latter has larger scales, a longer muzzle, and a much more angulate temporal region; the occiput is also well marked off from the nape by one projecting cross-row behind the postparietal, while there are three in G. auritus. Finally, its post-supranasals are not divided. Both these species are allied to the G. tæniatus and G. deppei of Wiegmann. Gray refers the latter to a genus *Abronia*, but a regular gradation of characters connect them with the other Gerrhonoti.

This is one of the Reptilian forms which inhabit the vast forests of Vera Paz, in the neighborhood of the ancient cities of Peten and Coban. Museum Smithsonian, Henry Hague discoverer.

Holcosus bridgesii Cope, sp nov.

This species is near the H. sexscutatus Günther, having quite the same coloration, that is, dark olive, with a pale vertebral band from the end of the muzzle and a lateral black band from the orbit, which is white-bordered above and below. The superior white line is much interrupted in this species. Top of head brown. below uniform light green. It differs considerably in the scutellation of the head. There is a pair of confluent supra- and prenasals in contact medially, and these are succeeded by a pentagonal internasal, but from this point the squamation is different; thus three plates represent each prefrontal, while some eighteen take the place of the frontal. Behind this point they are too numerous to homologize, except that a small median occipital is surrounded by series of tubercular or keeled scales, which are arranged in curved series running behind the occipital. The frontal scales are in three series, two larger superciliaries which are strongly keeled, and a median flat row, with those of the muzzle arranged quite as in species of Anales. Supraorbitals two on each side, each a half-ellipse, keeled on the inner margin, surrounded by granules except the anterior, which is in contact with the superciliaries.

The throat fold is covered with granular scales; Günther says H. sexscutatus has a series of shields. He also states that the hind limb extended only reached to the posterior margin of orbit; in the present species it reaches considerably in front of the orbit. Günther gives twenty femoral pores; in the present there are twenty-four on each side.

In other respects, as to squamation, scutellation, etc., Günther's description applies to this species. See Proc. Zool. Soc. Lond. 1859. The allied H. septemlineatus A. Dum. differs in the less divided scales of the front, as well as in being seven-banded.

This Saurian is dedicated to my friend Robert Bridges, M.D., Professor of Chemistry in the Philadelphia College of Pharmacy, and an active member of the Academy of Natural Sciences.

The species is represented by one specimen in the Museum of the Academy.

Opheomorphus mimus Cope, sp. nov.

This is the only species of the genus which has the black annuli on red ground, characteristic of Erythrolamprus and other genera of American Coronellines, Elaps, etc. Its general appearance is exactly that of E. venustissimus with single rings, or Ophibolus micropholis with confluent rings. It agrees entirely with other species of this genus in double anal, short tail, diacranterian dentition and lack of scale-pores, but is slightly abnormal in the rudimental condition of the loreal plate; it is on one side entirely wanting.

Superior labials seven, eye over third and fourth, fifth largely in contact with postoculars. First, the only one longer than high. Muzzle short, head slightly distinct. Internasals transverse; orbitals 1—2, the anterior not reaching frontal. Temporals 1—2. Scales in 15 series, broad as long. Frontal with straight sides convergent behind; its length greater than its breadth, and longer than common suture of occipitals, though shorter than greatest length of the latter. Tail 6·8 times in total length; *i. e.*, 2 in. 3 l. out of 13 in. 6 l.

General color crimson, each scale with a brown spot near its tip. Ten black rings of 3 and 3·5 scales in width cross the body. They are sometimes divided, and the halves alternate; they are complete across the belly, but have a tendency to divide, especially the posterior. One pair of complete annuli on the tail, and four spots above near the tip. No black collar, chin uniform: head above and spot below eye black; plates on sides of muzzle and temples black-edged.

The long posterior maxillary tooth of this species presents a singular structure. Its section is triangular, two of the sides being shallow concave. The angle between these is the section of an acute posterior ridge of the tooth; the anterior face of the tooth is convex. The posterior sides being slightly concave to the tip, in some lights suggest the presence of the groove of Erythrolamprns and other genera, but both are similar, and neither is a true groove.

The habitat of this species is a mining district in the higher regions of Equador or New Grenada, but the exact locality I cannot fix. It was found with the following species: Anolis fraseri Gthr., Rhabdosoma microrhynchum Cope, Holcosus bridgesii Cope, Opheomorphus mimus Cope, Amphisbæna fuliginosa L., Masticophis pulchriceps Cope, and Elaps sævus Cope.

Specimens in Mus. Academy from Edward Day, of the Assay Department of Columbia College, New York.

Liophis flavitorques Cope, sp. nov.

This is a small and aberrant species of the genus. Its peculiarity consists in a projecting rostral plate, as in Lygophis conirostris Gthr., which is consequently developed on the upper aspect of the muzzle. The tail is also rather longer than in any other species, its length entering the total 3·2 times. In this it approaches Dromicus.

Internasal plates about as long as wide; prefrontals considerably wider than long. Frontal with superciliary borders each one-third the anterior suture, and about half the occipital; thus the plate is very wide, with a long produced posterior angle. Each nasal higher than long, narrower than the loreal: latter higher than long, straight above, angulate below. Preocular higher than long, two postoculars; temporals 1—2. Superior labials seven, all higher than long except the last, third and fourth bounding orbit. The eye small, pupil round. Inferior labials seven, the fourth as long as any three others, the first well developed behind symphyseal. Geneials short, the posterior half the length of the anterior, and separated by a plate. Scales in seventeen series, rather broad, subequal. Gastrosteges 188; anal 1—1; urosteges 105. Total length 17·5 inches; of tail 5·5 inches.

Everywhere above dark brown, except a broad yellow half-collar which crosses the posterior half of the occipital shields and two rows of scales. Below dirty yellowish.

This serpent is from the Magdalena river, New Grenada. Brought by Schulte Buckow, of New York.

The physiognomy of the head of this species is somewhat like that of Oxyrhopus, though the characters are different.

Liophis persimilis Cope, sp. nov.

This species is very much like the Coniophanes fissidens Gthr. in general appearance; it differs generically in its uniporous scales and entire posterior maxillary tooth. It also resembles Rhadinæa obtusa, but differs also in dentition and pores. The form is more like the latter than the former, as the head is relatively small.

Scales in 17 rows. Frontal nearly as wide as superciliary suture; occipitals long, truncate behind; supranasals very small. Postnasal much larger than prenasal, loreal nearly square; preocular one, narrow, not approaching frontal. Two postoculars. Seven upper labials, eye over third and fourth; postoculars two; temporals 1—2—3. Inferior labials seven; post-genials longer than pre-genials. Gastrosteges 131 and 1—1. Urosteges 70.

Total length 11 in. 3 l.; of tail 3 in. 3 l. Above light brown, with a dark brown band on each side, from the neck to the end of the tail, which is dark bordered above on the lower edge of the fourth row of scales. Labial plates white edged above. Belly and tail below yellow, a black dot on the edge of each scutum and scutellum.

From Rio de Janeiro, Brazil; brought by the Thayer expedition. Mus. Compar. Zoology, No. 436.

Conophis pulcher Cope, sp. nov.

Scales in nineteen longitudinal rows. Loreal a little longer than high; orbitals 1—2, temporals 2—3. Muzzle rather projecting. Head little distinct. Superior labials, eight, higher than long except the last, fourth and fifth forming orbit below. Gastrosteges 73, anal 1—1; urosteges 67. Total length 29 in. 3 l., of tail 6 in. 3 l.; of gape 9·2 l.

Six dark longitudinal bands on a light ground. First a black band along the middle of the first row; second a dark brown black edged on the third and half the second and fourth; third a similar broadly black margined on the eighth and half the seventh and ninth, separated from its fellow on the other side by a median stripe of only one scale in width which is black edged. This median band disappears on the nape, leaving a broad band to the end of the muzzle, extending over the occipitals and superciliaries. The lateral band extends in like manner to the end of the muzzle including the upper edges of the labials. Throat clouded with blackish below. Belly yellow with a few specks on each end of the gastrosteges. Upper labials broadly brown edged below. The bands extend to the end of the tail.

From near Peten, Vera Paz. Henry Hague; Museum Smithsonian.

This handsome species is near the C. vittatus Peters, but differs in many points of coloration, and in having one more labial shield above and below. From C. lineatus D. and B., it differs also very much in coloration.

Helicops fumigatus Cope, sp. nov.

Scales in nineteen rows, keeled anteriorly and posteriorly, lower rows smooth.

Two pairs geneials; occipitals short and broad. Dark brown, with numerous lighter or dark gray cross bands, which are blacked edged, and extend to the first row of scales, and are sometimes interrupted on the vertebral line. Belly with a broad brownish gray band from throat to vent, the ends of the gastrosteges yellow, forming two bands; a median longitudinal brown line on the tail.

Tail 3·3 times in length. The plates of the head and other peculiarities are quite like those of H. angulatus.

From Surinam, Mus. Academy Natural Sciences. Discovered by Chas. Hering, M.D.

HELICOPS CYCLOPS Cope, sp. nov.

Scales in nineteen rows, strongly keeled everywhere, including the first row. Two pairs geneials; occipitals short and wide, long as frontal.

Head exceedingly short, mouth wide as the length of the rounded lip margin. Superior labials eight, fourth scarcely entering orbit by its upper corner (by its whole extremity in H. angulatus), the fifth, sixth and seventh narrow and high. Prefrontals broad as long (much broader than long in H. angulatus). Orbitals 1—2, nearly meeting below orbit. Temporals 2 | 1 | 3 (1 | 1 | 3 in H. angulatus). Loreal plate wide as high, (higher than wide in H. angulatus).

Tail ·33 total length, slender (less than ·25, H. angulatus). Gastrosteges 124, anal 1—1; urosteges 89.

Light yellowish brown, with twenty-six transverse deep brown rhombs across the back which terminate at the second row of scales, being separated from the back ventral cross-bar, which is opposite each, by a longitudinal yellow band. This band is not distinct between the spots. Belly strong yellow with jet black cross bars, which are on more than two gastrosteges. Tail black, spotted below. A brown cross-band between the eyes.

Length 27·5 inches. From Bahia, Brazil. Mus. Academy, from Dr. Otho Wucherer.

This species is at first sight much like the H. angulatus, but differs variously as above. In coloration the spots in the latter are always continued into the ventral cross-bars, and not interrupted as in A. cyclops.

The species of the genus are as follows: H. carinicauda Nieuw. H. modestus Gthr. H. leprieurii Dum. Bibr. H. chrysostictus Cope. H. infrataeniatus Jan. H. fumigatus Cope. H. cyclops Cope. H. angulatus Linn. H polylepis Gthr. The following species have been erroneously referred to this genus: *H. wagleri* Jan. is Tretanorhinus variabilis Dum. Bibr. *H. agassizi* Jan. is T. nigroluteus Cope. *H. schistosus* Jan. is Atretium schistosum Daudin, and *H. mortuarius* Jan. is Tropidonotus mortuarius (Boie) Schlegel (*Tropidinotus ferox* Günther).

THRASOPS PRÆSTANS Cope.

The largest species of the genus, exceeding considerably the T. flavigularis of Hallowell. The length of one sp. is 6 ft. 3 in., of which the tail is 2 ft. 3½ in., while the body of another measures 4ft. 6 in., giving a total of seven ft. 1 in. Length head to end of quadratum 1n in. 10 l., width between superciliary margins 8 lines, diameter orbit 4 l.; from orbit to end of muzzle 6 lines.

The head is very distinct, and the muzzle rather short for the genus; the eyes are very large. Rostral plate small, postnasal lower than prenasal; place of the loreal entirely occupied by the prefrontals Orbitals 1—2, the anterior not quite reaching the frontal. Frontal one-sixth longer than wide in front, with concave sides and short posterior angle. Occipitals broad, short, divaricate behind; temporals 1—2. Superior labials nine, fifth and sixth in orbit, last two longer than high. Inferior labials 11, the anterior very wide; postgenials longer than pregenials.

Scales in fifteen rows for a part of the length, in eleven. on the posterior half of the body. They are without pores on the side, but are uniporous on most of the rows. All the rows except the inferior, are carinate. On the middle and posterior part of the length, that of the vertebral becomes obsolete, and then vanishes, while those of the two on each side, especially the superior, become very strong. Tail entirely smooth. Gastrosteges 180. Anal divided; urosteges 176; the first are strongly turned up at the sides, and not angulate.

The teeth increase in length gradually to the posterior end of the maxillary bone, where the last is abruptly the largest; they are strong, and eleven in number.

Color everywhere bluish green without metallic reflection, the keels of all the scales black.

This beautiful species was sent to the Smithsonian Institution by its correspondent Henry Hague, near Peten, Guatemala,

Leptodira pacifica.

Scales in nineteen series, biporous, all nearly equal. Body cylindric, neck little compressed; head short, broad. Oculars 2—2, loreal higher than long. Superior labials seven; eye over third and fourth. Temporals 1—2. Frontal longer than broad, with straight parallel borders; occipital elongate, truncate behind. Internasals long as wide, one-third prefrontals. The superior pre- and postoculars are both much larger than the inferiors Gastrosteges 164, anal 1—1, urosteges 61 pairs. Length of head and body 7 in. 3 l., of tail 2 in.

Color above bright rose-brown, with four series of blackish-brown, very small spots, of which the median pair forms usually a short cross-bar by their union; in this case they extend over five series of scales. The lateral spots are on the fifth row, and cover half a scale. A broad black bar across the nape; a short brown line behind each eye, and a number of dots on the crown. Below uniform cream color.

The above description is derived from a young animal. It was given to the Smithsonian Institution by its correspondent, G. Bischoff, and sent to me for examination. In its characters it approaches the species of Hypsiglena (*Pseudodipsas* Peters,) but has a grooved maxillary tooth and double scale-pores. It has different labials, scales and coloration, from the L. annulata.

Leptodira personata Cope, sp. nov.

Body slightly compressed, neck contracted, head elongate, narrowed in front of the orbits. Scales equal, biporous, in twenty-three rows. Internasals broader than long, frontal elongate, with parallel sides, superciliaries narrowed, occipitals narrowed, elongate, rounded behind. Temporals 1—2; oculars 1—2, anterior barely reaching frontal; loreal long as high. Superior labials eight, fourth and fifth in orbit. Geneials equal. Gastrosteges 173, anal 1 | 1 |, urosteges ? (tail mutilated). Length head and body, six inches.

General color cream, with broad black cross-bands on the dorsal region. These extend from the gastrosteges anteriorly, posteriorly from the first series of scales. There are twenty-three between nape and vent, which are wider than the intervals. Top of head except upper labials entirely black; a broad yellowish collar. Below immaculate.

The Smithsonian collections have received this species from Mazatlan, Western Mexico, from G. Bischoff. It was sent with the Leptodira pacifica, Agalychnis dacnicolor Cope, and Holbrookia bischoffi Cope and other species.

Phimothyra decurtata Cope.

This species resembles considerably the species of Lytorhynchus Peters, which genus in Africa represents the American Phimothyra. They differ only in dentition, the former being diacranterian, the latter rather coryphodont.

This species is distinguished by many features. The head is shortened and somewhat arched, the rostral plate very broad and free, entirely separating the internasals. There is a complete annulus of scales round the eye. The tail is relatively shorter than in the known species.

Ground color light grey; a series of elongate parallelogrammic brown blotches occupies the dorsal region, from the nape to the end of the tail. Labials and under surfaces unspotted.

Length about fourteen inches. This serpent is remarkably different from the three already known representatives of the genus. In these the orbit rests on the labials, and the color is in bands.

Presented to the Mus. Acad. Nat. Sci. by Wm. M. Gabb, who discovered it in the upper part of Lower California.

PELTAPHRYNE LEMUR Cope, sp. nov.

This is a toad of singular aspect, owing to the extraordinary development of the bony crests of the cranium and the large size of its eyes.

The muzzle is short and very much flattened, projecting much beyond the mouth. The upper lip forms indeed a strongly projecting bony rim all round the mouth. Loreal region very concave, canthus concave and very close together. The superciliary crests are extraordinarily elevated, having an arched outline, and descending steeply to the loreal region. It is angulate posteriorly, joining the almost equally developed supratympanic ridge. The crown of the head is thus a deep basin, widened above the tympana, and obstructed by a cross-elevation in front. Strong ridges behind and before the orbit: nostrils vertical, a short bony longitudinal ridge below them. According to the characters of the genus there is no derm on the head. Tympanum vertically oval. Parotoids broad oval, directed obliquely downwards, covered like the remainder of the upper surfaces of the body and limbs, with numerous closely placed sub-round tubercles, with rugose surfaces. Feet rather short, with small tubercles, and only one remarkably weak metatarsal tubercle, the inner. A strong corneous ridge on the inner margin of the tarsus. The heel reaches the middle of the parotoid. The toes are about half-webbed, and have a strong dermal margin. Two strong carpal tubercles. Under surfaces studded with small tubercles, with acute points. Tongue obovate, largely free.

	In.	Lin.
Length head and body	4	5·5
" to axilla	2	
" " posterior margin tympanum		15
" " anterior margin orbit		6
" of fore limb	2	5 5
" " hind limb	4	3·5
" " " foot	2	4
Width of head behind		17·5
" interorbital space		8·5
" top of muzzle		1·3

The color above is a blackish-brown, the top of the head yellow shaded: two longitudinal brown spots on the frontal region. A light vertebral line disappears on the back and reappears on the coccyx, and another light line passes round the inside of the parotoids and diverges on the scapular region. Limbs yellowish cross-banded, below dirty white, below the vent blackish.

This curious animal was found by George Latimer, the correspondent of the Smithsonian Institution in Porto Rico, W. I. We are indebted to the same zoologist for the following species:

PELTAPHRYNE LEMUR Cope.

CYSTIGNATHUS ALBILABRIS Gthr. var.

HEMIDACTYLUS MABUIA Cuv.

MABUYA FULGIDA Cope.

DIPLOGLOSSUS DEGENER Cope.

ANOLIS VELIFER Cuvier. The female of this species would fall in the "genus" *Eupristis* Fitz.=*Dactyloa* Gray.

TYPHLOPS sp.

CHILABOTHRUS INORNATUS Dum. Bibr. Only found elsewhere in Jamaica.

ALSOPHIS SANCTICRUCIS Cope (=*A. melanichnus* Cope).

OTASPIS EMPUSA Cope. *Peltaphryne empusa* Cope, Proc. Acad. Nat. Sciences, Philad. 1862, p. 344.

This species does not belong to Peltaphryne, but to a genus which I now name. It differs from the former in the existence of an additional superficial arch of the skull, which passes from the mastoid region behind the auricular meatus, thus enclosing the latter, and causing it to be a mere foramen perforating a shield of bone. This is the only genus of living Batrachia in which the external ear is thus completed behind. It is a tendency of Peltaphryne carried to its highest extreme.

Cuba; found by Prof. Poey.

LYSTRIS BRACHYOPS Cope, sp. et gen. nov. Cystignathidarum.

Tribe *Pleurodemæ*, same group as Pleurodema, differing only from that genus in the presence of two strong shovel-like metatarsals, as in the genus Systoma.

Its characters are, therefore: cranium with a fronto-parietal fontanelle; xiphisternum an osseous style, with furcate cartilage disc. Vomerine and maxillary teeth well developed; a large inguinal gland; two metatarsal shovels.

It differs from Gomphobates in its fontanelle and vomerine teeth, but is intermediate between this genus and Pleurodema, showing that the tribes Pleurodemæ and Cystignathi should be closely approximated. It differs only, so far as we know the characters, from Eupemphix Steind., in the presence of a well-developed dentition in adults as well as young. The other characters of Eupemphix are not yet known, or whether it is nearer this genus or Gomphobates. Steindachner's second species of Eupemphix I would refer here, and call it Lystris f u s c o m a c u l a t u s. Name of the genus from Λυστρον, a trowel.

Char. specificus.—Vomerine teeth in two short oblique series directed forwards between the nares, about as far from the latter as from each other. Tongue a flat oval, one-third free. Head broad, occiput slightly swollen, canthus rostralis straight, obtuse, convergent; loreal region vertical plane. Diameter of bony orbit equal length of muzzle; the latter contracted, elevated, rounded in profile; nostrils nearer end than orbit. Membranum tympani one-third orbit. Ostia large as nares. Males only with a subgular sac, with large lateral slits. Limbs short, stout; the heel barely reaching the tympanum. Toes quite short, free, without dermal margins. No tarsal median tubercle or fold. Inguinal gland large subovate. Skin smooth above and below; a few ill-defined warts on the back. Lengths of fingers 3—2—1—4.

	In.	Lin.
Length head and body	1	8·5
" muzzle to posterior edge tympanum		7
" hind limb	2	2
" foot		12·5
" tarsus		4·8
Width head just behind tympanum		6·4

Color above dark brown, with several darker brown broad irregular bands, which cross the back in three places or are broken into spots, and are sometimes confluent longitudinally. Sides with dark brown lines and specks. Lip with two vertical brown bands on each side. Inguinal glands black, white speckled. Limbs brown, deeper banded; sole from heel dark brown. Below yellow, gular region brown.

Magdalena River, New Grenada, Schulte Buckow, collector.

Spelerpes lineolus Cope, Proc. Acad. Nat. Sci. Philad. 1865, 196. *Ophiobatrachus vermicularis* Gray, Ann. Mag. N. Hist. 1868, 297.

This species varies somewhat in the relative length of the tail. One of the specimens from Cordova, Vera Cruz, measures as follows: head and body 17·3 lines; tail 2 in. 10·4 lines.

In the collections of the Smithsonian Institution.

Grotriton carbonarius Cope.

A uniformly black variety of this species occurs in the high lands of Guatemala, and another with two dorso-lateral ochre bands is found in Yucatan. Mus. Smithsonian.

Dec. 1st.

The President, Dr. Hays, in the Chair.

Thirty-five members present.

The following papers were presented for publication:

"Notice of some remains of extinct Insectivora from Dakota." By Dr. J. Leidy.

"Observations on Reptiles of the Old World. Art. II." By Edw. D. Cope.

"Notes on some points in the structure and habits of the Palæozoic Crinoidea." By F. B. Meek and A. H. Worthen.

Dr. Leidy exhibited some specimens of Mica recently received from Westport, Canada, remarkable for the beauty and distinctness of its asterism, produced by minute acicular crystals profusely scattered between the laminæ. The star exhibited twelve equidistant rays, exceeding in strength any previously seen by him in varieties of the mineral.

Prof. Cope made some observations on some extinct reptiles of interest. One of these, represented by a single sacro-caudal vertebra from Swedesboro', N. J., indicated a second species of Elasmosaurus. It was of equal size with the corresponding one of the Kansas specimens, but differed in the square and uncontracted form of the centrum, and greater stoutness of the diapophyses. He called it E. orientalis.

Another reptile was represented by a vertebra, tooth, and portion of mandible. It was a gavial-like crocodile, which if of proportions similar to those of the Gangetic species, would indicate an animal of thirty feet in length. It belonged to the genus Thecachampsa Cope, and was allied to the T. antiqua (*Crocodilus* Leidy), but differed in the more compressed knife-like tooth crowns. Miocene of Maryland.

He also exhibited bones and teeth of a large Rodent from the cave deposits of Anguilla, one of the Virgin West India Islands. The characters observed were those of the genus Chinchilla, but the roots of the teeth were contracted and not so open as in many Rodents, as though having a more limited period of growth, or perhaps like deciduous teeth, which are much reduced in number in most Rodents. The species was nearly as large as the Castoroides ohioensis of North America, but had relatively smaller incisor teeth. The body was probably as large as that of the Virginia deer, and the limb bones as stout, as seen in portions of femora and other pieces preserved. He called the animal Amblyrhiza inundata, and thought that its discovery on so small an island, with others of like character, indicated that the Carribean continent had not been submerged prior to the close of the Post-pliocene, and that its connection was with other Antilles, while a wide strait separated it from the then comparatively remote shores of North America.

Mr. Meehan stated that it is a fact well-known to most of us, that the *Wisteria sinensis*, as we find it cultivated, rarely produces fruit. The large seed vessels I now present are from a plant I have which bears abundantly. Why it does so I think may prove of interest to the members.

A few years ago Darron discovered motion in tendrils. Subsequently, in a paper published in our Proceedings, I showed that this motion required nutrition for its force, which was so much abstracted from growth. I explained by this what had hitherto been a mystery, why grapes grew more freely and healthy when running over trees, than when exhausting their vigor in fruitless motion to find something to cling to. I referred to many plants on which I had experimented, amongst others *Wisteria sinensis*; a plant was trained a few feet hign and then left to support itself. It took all its food to fight gravitation. Since then it has continued to grow as a bush or small round-headed tree, unless a branch happens to extend to the ground, or a neighboring bush, when such branch will push forth with its old time vigor. In proportion as this plant has lost the power of growth, it assumes a reproductive power. This year from my little Wisteria *tree* I have gathered a half-peck of seed pods.

That weakened vigor is favorable to reproduction is well known to the horticulturist. Hence the operations of root pruning, transplanting, summer pruning, and ringing the bark. The novelty of this Wisteria incident is that an excessive draft on the force necessary to overcome gravitation in the ascending plant is also an enfeebling cause.

The facts I have given have a three-fold interest. To the structural botanist, enabling him to get specimens of fruit for examination hitherto hard to be obtained; to the horticulturist, furnishing him with the means of freely propagating a plant hitherto rather difficult to increase, and to the natural philosopher, furnishing an additional illustration of what I have hitherto advanced, *that growth in a great measure is a struggle with gravitation, requiring great efforts by the nutritive powers of the plant to sustain it.*

Dec. 8th.

The President, Dr. Hays, in the Chair.

Thirty-one members present.

Dec. 15th.

The President, Dr. Hays, in the Chair.

Thirty-four members present.

The following paper was presented for publication:

"On the seed vessels of Forsythia." By Thos. Meehan.

Mr. Cope offered the following resolution which was adopted:

Resolved, That the Academy of Natural Sciences present their thanks to Theophilus H. Turner, M. D., U. S. A., for his very valuable gift of the skeleton of the great extinct reptile, the Elasmosaurus platyurus, from the neighborhood of Fort Wallace, Kansas.

Dec. 22d.

The President, Dr. Hays, in the Chair.

Thirty-four members present.

The following papers were presented for publication:

"Remarks on some new types of Carboniferous Crinoidea, with descriptions of new forms." By F. B. Meek and A. H. Worthen.

"Descriptions of seven new species of American Birds from various localities, with a note on Zonotrichia melanotis." By Geo. N. Lawrence.

"Analytical table of the species of Baridius inhabiting the United States." By John L. LeConte, M. D.

"The Gyrinidæ of America, north of Mexico." By John L. Le Conte, M. D.

"Notes on the species of Agonoderus, Bradycellus and Stenolophus inhabiting America, north of Mexico." By John L. LeConte.

Dr. Leidy exhibited some photographs of fossil bones, received from Mr. W. E. Webb, Sec. of the National Land Co., at Topeka, Kansas. They represent vertebræ, and fragments of jaws with teeth, of a skeleton of Mosasaurus, reported by Mr. Webb to be about 70 feet in length, recently discovered on the great plains of Kansas, near Fort Wallace.

Dec. 29th.

MR. JOS. JEANES in the Chair.

Fifty-three members present.

The following gentlemen were elected members:

Albert Peale, Franklin Platt, Jr., Edw. A. Spooner, M. D.

The following were elected correspondents:

Geo. Neville, of Calcutta, E. I.; Rev. Dr. Joseph F. Berg, of New Brunswick, N. J.

The Committee to which was referred a paper, entitled "Phosphorus and Fatty Degeneration," reported in favor of its publication in the American Journal of Medical Science.

On favorable report of Committees, the following papers were ordered to be published:

Notice of some remains of extinct INSECTIVORA from Dakota.

BY JOSEPH LEIDY.

Dr. Hayden, in his trip to the Mauvaises Terres of White River, Dakota, in the summer of 1866, discovered the remains of two genera of insectivorous mammals, which appear to be peculiar, but related to the hedge-hogs.

LEPTICTIS HAYDENI. This name, appropriate to one of the animals, is founded upon a nearly entire skull devoid of the lower jaw. The specimen belonged to a mature animal, as indicated by the complete and worn condition of the teeth; but the skull retains most of its sutures as distinctly as is usual in the Opossums. It is less in size than that of the Mink, and its shape is more canine than musteline. It bears some resemblance in form to that of the insectivorous genus Glisorex, or to that of the viverrine genus Eupleres.

The cranium is remarkable for the possession of a pair of prominent ridges defining the upper part of the temporal fossæ, as in the fossil cranium represented by De Blainville (Osteographie, Mustela, pl. xiv) under the name of *Mustela plesictis* from Auvergne, and by Gervais (Pal. Fran. pl. 28, fig. 2) under the name of *Mustela angustifrons*. Similar ridges, relatively less well-developed, exist in the Gray Fox.

The orbits are as little distinct from the temporal fossæ as in the Skunk or the European Hedge-hog.

The cranium back of the orbital spaces is conoidal and wider than high. It is narrowest just back of the postorbital eminences; relatively not so much constricted as in the Mink or Fox, though more than in the Skunk or European Hedge-hog.

The face is long, and tapers evenly to the end of the snout.

The palate is long, narrow and moderately arched, and exhibits no large perforations as in the Opossums.

The fossil retains most of the teeth, the number of which consists of seven molars, a canine and two incisors.

Of the molars the posterior four have broad trilateral crowns, with a number of points or tubercles, as in the Opossums and Hedge-hogs, or the back two in the Dog. The anterior three molars have simple, compressed conical crowns. The canine is comparatively small. Whether the animal possessed more than two incisors on each side is uncertain.

Measurements from the specimen are as follows:

Estimated length of skull from occipital foramen to fore part of incisive alveoli	29 lines.
Length of cranium from inion to fronto-nasal suture	$18\frac{1}{2}$ "
Breadth at zygomata	$17\frac{1}{2}$ "
Length of palate	$15\frac{1}{2}$ "
Length of molar series	11 "

ICTOPS DAKOTENSIS. This name is founded on a small fragment of a skull which was obtained with the preceding. At first the specimen was supposed to belong to the same animal as the former. It clearly indicates a skull of nearly the same size and shape as that of *Leptictis*.

The fragment consists of a portion of the face, containing the remains of most of the molar teeth. The face appears to have had nearly the same form and construction as in *Leptictis*, and the forehead exhibits traces of the two peculiar ridges defining the upper part of the temporal fossæ in the latter.

The remains of the molars consist of the posterior six. The second premolar appears to have been a two-fanged, conical crowned tooth, as in *Leptictis*. The third premolar has a trihedral crown, inserted by three fangs, whereas in *Leptictis*, as in the preceding tooth, it has a simple conical, crown with a pair of fangs.

The crown of the third premolar of *Ictops* is composed of three principal lobes, two external and the third internal. The four back molars have the same relative position and size as regards one another as in *Leptictis*, but they do not project abruptly beyond the premolars externally as in this. Their crowns, so far as can be ascertained, appear to have had the same construction as in the third premolar.

The space occupied by the back six molars in *Ictops* is ten lines, being a little more than in *Leptictis*.

Observations on REPTILES of the Old World. Art. II.

BY E. D. COPE.

CHAMÆLEO BASILISCUS Cope, sp. nov.

This species pertains to group α. of Gray's arrangement of the species of this genus (Proc. Zool. Soc. Lond., 1864), that is, is nearest allied to C. verrucosus Gray, and C. calyptratus A. Dum. It has therefore a high longitudinal crest on the supraoccipital region, and the supraoccipito-mastoid crest is not furnished with any dermal margin of flap behind, but is the margin of a truncate face which is minutely scaled. No dorsal or ventral crests except a few conic scales above the scapulæ. Gular region with a weak crest.

The occipital elevation is vertical behind, the lateral ribs but little oblique, and joining the superciliary crest at a little more than a right angle. Median crest very convex, nearly vertical below. Superciliary crests continuous, not arched, descending straight and obliquely to the muzzle. None of the crests dentellated. Scales everywhere granular, equal. Nine rows of subequal scales between lateral and median occipital crests; six between canthus on the muzzle. Tail little compressed.

Color gray and leaden, with yellow shades. Three blackish radii back of orbit. A yellow band from chin to vent.

Total length 12 in. Muzzle to vent 5 in. 4·5 lines. Muzzle to orbit 6 lin. Length of hind limb 2 in 6 l.

This species was obtained at Korusko, Nubia, by Prof. H. A. Ward, and placed in the Museum Peabody Acad., Salem, Mass. No. 489.

This Chamæleon resembles the C. v u l g a r i s, and is intermediate between it and the C. v e r r u c o s u s.

It may be observed that the Chamæleo b u r c h e l i i of Hallowell cannot be regarded as more than a variety of C. g r a n u l o s u s of the same author, and that *C. capellii* Du Bocage appears to be the same so far as the description goes.

PANASPIS ÆNEUS Cope, sp. et gen. nov. Scincidarum.

Char. genericus. Allied to Morethia Gray, differing only in the distinctness of the fronto-parietals from each other and from the interparietal, all three being united in the latter genus. No eyelid; a supranasal; rostral not prominent. Limbs short, toes weak, 5—5. Scales smooth.

Character specificus. Scales large, in twenty-four longitudinal series. Two loreals, one behind the other; two preoculars, one above the other. Frontonasals broad as long, separated by frontal, which reaches the internasal. Frontal acute behind, smaller than each frontoparietal, but a little larger than the interparietal. Lateral parietals meeting behind the last named, and followed by two transverse scales each. Superciliaries and suparorbitals four each. Two large marginal anal scales.

General proportions slender, the head remarkably so, the tail proportionately stout. The appressed extremities do not meet by the length of the longest finger. Toes 1 and 5 equal, 3 and 4 nearly so, elongate. Inner finger very small. Superior labials eight, fifth immediately below orbit, last three scale-like, large; anterior quadrate. Tail with cross scuta beneath.

Total length 3 in. 5 lin. To vent 15 l.; to axilla 6 lin.; to ear 3 l.; to orbit 1·2 l. Length fore limb 3 lin.; hind limb 4·5 l

Color. Golden olive above, darker behind, with a narrow golden line on each side from the temple to the base of the tail. Sides above darker, below lighter, pale spotted A whitish line from below eye to near axilla. Limbs and tail above brown, with small round white spots; below greenish white; tail pale brownish beneath.

Habitat. Probably Swan River, Australia; possibly from South-Western Africa.

Name, from its complete cephalic scutellation, all the plates usual among lizards being present.

EUMECES PERDICICOLOR Cope, sp. nov.

Twenty-eight series of broad scales on the body, all entirely smooth. Body fusiform, the limbs very short, with short but unequal toes. Tail cylindric.

Rostral plate low, broad, prominent, but not acute. Infranasals as long as broad, largely in contact. Internasal much broader than long; frontonasals small, widely separated. Frontal long, rounded behind; fronto-parietals well in contact, large, rounded behind; inter-parietal smaller than the latter, parietals well in contact behind it. Dorsal scales equal, a little smaller than ventrals. Ear large, membrane deeply placed; no marginal tubercles or scales. Nasals not divided; preloreal higher than postloreal; two preoculars. Superior labials seven, fourth long, below orbit, no suborbital plate. A transverse symphyseal, and broad transverse mental. Inferior labials seven. Five supraorbital plates. Scales in front of vent equal.

	In.	Lin.
End of muzzle to vent	3	3
" " to axilla		13
" " to orbit		2·7
Length of fore limb		5·9
" hind "		8·2

Color above brown, uniform on the back, each scale with a large white spot near the centre, on head, body and tail. Lower labial and gular scales white, with a brown spot, upper labials brown, with a white spot; white below, all the scales brown edged; in a younger specimen laterally, only in an older all round.

This well marked species is a native of Zanzibar. Mus. Academy and Peabody Acad. No. 499. From H. F. Shepard. I have referred this species to the genus nearly as restricted by Dr. Gray, including with it *Plistodon* and *Otosaurus* of his catalogue, as forming together a definable genus.

SEPSINA Bocage.

Sepsina grammica Cope.

Scales in 22 rows. Limbs small, the anterior one-third the length of the posterior; toes 3—3. Nostril between four plates; frontonasals and internasals united into a shield which is broader than long. Supraorbitals and superciliaries four each on each side. Frontal concave behind, and wide as long; interparietal nearly as wide, large; two pairs of parietals, the interior meeting behind; two pairs transverse plates behind them. Nasal, loreal and preorbital present; rostral flattened, not acute. Eye over fourth labial. Anal and abdominal plates equal. Ear minute.

Length to ear 8″ (French); to axilla 15″ 75‴. Axilla to groin 5′ 5″. Fore limb 2″, posterior limb 7″. Tail elongate, mutilated.

Below brownish yellow, above fawn brown; four rows of scales on each side, with a dark line in the centre, forming interrupted streaks. Hind limb streaked above in the same way. Tail more distinct, spotted, on the under surface faintly; above dark banded.

This species differs from the type described by Bocage, (Journal de Sciencias, Mathematicas, Physicas e Naturæ Lisbon, 1866, 26), in its coloration, in having two rows of scales less; in having fore limbs very much smaller, less than one-third the posterior, (they are more than one-half the same in the S. angolensis Boc.). In the latter the internasal and frontal are much more elongate, and the interparietal very much smaller, according to the description and figure of the above author.

Museum of the Essex Institute. No. 512. Discovered by Edmunds Lovett, on the South-West Coast of Africa.

Oedura verrillii Cope.

The femoral pores in a series arched angularly forwards and not extending on the femora. The plates of the under surfaces of the toes are besides the terminal discs, one pair only, as large as the terminal and at the end of the antepenultimate phalange. Labials regular, 8—7 to below pupil; two rows infralabials across chin. Rostral undivided. Gular scales granular; thoracic and ventral flat, larger than the flat dorsals. Muzzle scales tubercular. A tubercle on each side vent. Head as broad as from end of muzzle to half way between orbit and ear. Color very pale above, with six very deep brown cross bands from nape to sacrum, which are more or less connected on the sides. A brown band through orbit, and one behind, crossing the occiput.

Muzzle to ear 12′′; to axilla 20′′·5. Axilla to groin 25′′; tail lost. Fore limb 13′′; hind limb 18′′.

With Diplodactylus marmoratus Gray, from Australia. No. 724. Mus. Comparative Zoology, Cambridge, Mass.

Dedicated to my friend Addison E. Verrill, Professor of Zoology in Yale College, Connecticut.

PEROPUS Wiegm.

Three species of this genus before me differ from those described, and may be compared as follows:

I. The tail much depressed, and with a series of broad shields below.

Margin of tail minutely serrate; two internasal plates; mental plates abruptly different from gular scales, in one cross row of six, and smaller ones at the angles in front of a straight cross-line. Pale brown with close reddish speckles.. .P. packardii.

II. The tail broad, depressed, slender, with small scales below.

A few internasals, two longitudinal rows, hexoganal mentals; gray with scattered brown spots...P. mutilatus.

III. Tail thickened, depressed, cylindric, without serration; scaled below.

Four cross rows ovate mental plates, the posterior smaller; three internasals; pink-grey, with brown later shade, with pairs of black dots on each side the middle line, which form striæ on the scapular and crural regions. Tail subcylindric..P. roseus.

Two cross-rows ovate mentals, those behind graduating through several rows to the gulars; four internasals; tail swollen; light gray with a brown band on each side...P. pusillus.

PEROPUS PACKARDII Cope.

This is a stout species. Günther's description of Peripia peronii Gray applies well to this, but in our animal the toes are all strongly palmate at the base.

Upper labials 9—7 to under the eye, lower seven; symphyseal large, triangular. Gular scales very minute, ventıals larger than laterals, and laterals than dorsals. A thick femoral fold behind. Pores in a long line, from 35 to 40.

Light reddish brown, with small bay specks all over the upper surface. Several small round bay margined spots on the occipital and temporal region.

Head and body to vent 42′′; muzzle to ear 11′′·5; width at ear 8′′·7, of tail 6′′. Length of hind limb 14′′·7.

Penang, Malacca. No. 476. Mus. Peabody Academy, Cambridge, Mass.

PEROPUS ROSEUS Cope.

This species is remarkable for its nearly cylindric tail. I find no femoral pores in two individuals, but a rather large series of scales abruptly divides the granular from the scaled portion of the femur, in their position. Upper labials eight to below orbit. No posterior femoral fold. Dorsal scales extremely minute. General form more slender than in the last species.

A black spot on each scapular, and one above each axillary region; one on the iliac, and a line above each ischiadic region; a row of black dots on the vertebral line of the tail. A brown band from end of muzzle to ear, then a black line to axilla.

Total length 77′′; to vent 40′′; to ear 10′′; width at ear 4′′·7.

No. 735. Mus. Comparative Zoology.

PEROPUS PUSILLUS Cope.

This little reptile differs from the last in the three structural and fourth coloration characters, beyond which it is difficult to observe further peculiarity. There are nine superior labials to below the pupil; there is no femoral fold, nor are there femoral pores. Color light brown, with a much paler dorsal shade; a brown band through orbit to axilla, and band across muzzle. Tail with a series of pale rounded spots on the median line above.

Total length 59″; to vent 35″; to ear 9″; hind limb 12″·5.

No. 407. Mus. Peabody Acad. S. W. Australia.

HEMIDACTYLUS Cuv.

Hemidactylus longiceps Cope.

This species is like the H. coctæi D. B. in its very sparse tuberculation, for this appears in a single line of obtuse distant warts, on each side the lumbar region only. The thumb has a claw, however, and the tail is surrounded by rings of prominent tubercles. It has fewer tubercles than the H. frenatus, and differs further in having a long flat slender muzzle. The width of the head behind the orbits does not measure from the end of the muzzle to the posterior margin of the orbit, while in the H. frenatus it reaches the rictus of the mouth. Labials 10—9; mental projecting behind; postmentals two pair, the outer considerably smaller, the inner largely in contact. Femoral and preanal pores in one series.

Light reddish-brown, with a pale dark brown bordered ochraceous band from the end of the muzzle to the groin. Dorsal region brown-shaded; below white.

Length to vent 47″; to axilla 24″; to ear 13″.

Manilla; from Capt. J. W. Chever. Mus. Peabody Academy, Salem, Mass. No. 478.

Hemidactylus hexaspis Cope.

Tubercles flat, round, sparse, in a row on each side the median vertebral line, and three rows on each side, at a distance from the former. Caudal tubercles in three rows on each side. Labials 11—8, symphyseal produced behind; postmentals abruptly larger, three on each side, the median pair in contact half their length, the outer diminishing regularly. Femoral and preanal pores continuous in the male, both wanting in female. Three internasals; no tubercles on head or nape. Abdominal scales ovate, rather large.

Plumbeous above, with numerous pale blotches; a pale band from end of muzzle to groin, margined with leaden above and below, in the female with blackish; top of muzzle dark shaded above.

Length to vent 57″; to axilla 25″; to ear 13″.

Two specimens from Madagascar. No. 494, Mus. Peabody Academy.

This species is also related to the H. frenatus, but differs in the arrangement of the dorsal tubercles, and in the chin shields.

I may note here that the Liurus capensis (*Hemidactylus capensis* Smith, Zool. S. Afr.) occurs in the copal of Zanzibar. A specimen over two inches long, enclosed in a block of this substance, is in my possession. Its skeleton and viscera have been dissolved, and form a thick fluid easily visible on moving the specimen. The specimen has been included some time before the solidificaiion of the gum, as the gases evolved during decomposition have raised large bladders in two places in the specimen. Another Gecko, probably a Hemidactylus, also occurs in the copal.

Pentadactylus brunneus Cope.

Nostrils surrounded by four small shields and the first labial, the rostral being excluded. The anterior of the scales separated from its fellow by a polygonal scale, which is not included in a notch of the rostral. Rostral fissured above. Superior labials eleven, last two minute; two or three of them longer than high. Distinguishable inferior labials nine; two first much deeper than long. Infralabials not marked, forming some four or five rows of small ovate scales. Scaling of the body coarse. No superciliary spine; no preanal pores. Free joints of the toes, especially of the thumbs, thick.

Tail with whorls of flat hexagonal scales, abruptly separated from those of the sacrum above.

Color above brown, with seven irregular undulate, transverse bars of a very deep brown, between rump and nape. Below pale.

	In.	Lin.
Total length	5	7·5
Length from muzzle to vent	2	8·5
" " " axilla	2	4
" " " ear		9
" " " orbit		4
" of hind limb		14

Australia. Mus. Jardin des Plantes, in ex.

This species is nearest the Pl. duvaucelii D. and B.; the differences may be readily determined by comparison with Günther's description in Reptiles Brit. India.

PTENOPUS MACULATUS Gray, Proc. Zool. Soc., London, 1865, 640.

Character genericus.—Toes with transverse series of very narrow, simple plates beneath. Posterior toes all turned forwards, with a series of long processes forming a fringe on each side; posterior claws issuing from above a broad paralellogrammmic lamina. No femoral pores. Ears distinct. Nostril pierced in a single plate. Eyelids each half developed.

This genus is near to Stenodactylus Cuv. and Spatalura Gray, but differs markedly from both. The tail is not flattened and fringed as in Spatalura, while the terminal plates of the toes and single nasal plates are marked characters.

As Dr. Gray referred this genus to the Agamidæ I was induced to make an examination of the skeleton. As a result of this, I am satisfied that it belongs to the suborder of the Nyctisaura and the family Geeconidæ. In evidence for this I append the following characters: 1. The dentition is pleurodont. 2. The parietal bones are separate. 3. The vertebræ are amphicœlian. 4. There is no subarticular bone. 6. The coronoid process of the mandible is not produced posteriorly. As characters of a higher or a lower significance the following may be added. The angular bone is distinct, there are four abdominal ribs, and three attached by long hæmapophyses to the posterior margin of the xiphisternum. The dentary bone is prolonged below unusually far posteriorly, *i. e.*, to half way between the coronoid and articular processes.

Character specificus.—Head large, slightly compressed. Muzzle short, obtuse. Nasal plates two, forming a round disc, which is only in contact with the nostral and first labial, and separated from its fellow by a granule. This disc has its posterior third separated from the remainder by a suture; the nostril is in the anterior plate near the suture. Rostral not fissured, broader than high. Superior labials longer than high, large, seven on each side. Inferior seven (to opposite sixth superior) narrow, longitudinal. Symphyseal prominently rounded below, broader than high. No infralabials; gulars not smaller.

Dorsal scales equal, hexagonal, flat; nuchals minute, occipitals, frontals and nasals a little larger than dorsals, flat. Caudals equal to dorsals, flat, whorled. Tail vertically flattened at the end. Fingers and toes long, slender; former lengths 5—1—2—4—3; toes 1—5—2—3—4. Fingers not fringed; claws long, compressed, not concealed, but with a smooth basal sheath. The posterior toes are entirely different, in the long fringes, terminal plates, and the perfectly straight spine-like claws, which project from the middle of the end of each plate; the arrangement is a little like the body of a slender Oniscus, whence the name of the genus. The long cross-plates are not serrate, but are rigid; they are separated from the series of fringe-like scales by some series of granules. The tail is slender, short, and slightly compressed. No tubercles at base. Vent with a short fringe all round.

	In.	Lin.
Total length	3	6
Length to vent	2	1
" " axilla		11
" " ear		5·2
" " orbit		2
" of hind limb		12·5
" " foot		6
Width of head at ears		5

Color.—Above light gray, with a rose shade on the neck and nape. Five pairs of irregular black annuli, one on each side the vertebral line, from rump to nape. These are more or less broken, especially anteriorly. They are replaced by scattered linear spots on the top of the head. The arrangement reminds one of that seen in the Felis u n c i a. Seven pairs of spots on the upper surface of the tail form cross-bars. Labial plates brown edged; below everywhere delicate straw color.

Habitat at Cape of Good Hope. No. 725, Mus. Comparative Zoology, Cambridge, Mass.

This interesting little Saurian is furnished with a large calcareous mass on each side the neck behind the os quadratum, which gives its head an appearance of length. It is no doubt an inhabitant of a sandy region, judging by its color and the structure of its hind feet, which appear to be adapted for excavating. It is no doubt allied to the Stenodactylus g a r r u l u s of Smith, but differs in numerous respects from the description of the latter author.

LETHEOBIA PALLIDA Cope, gen. et sp. nov Typhlopidarum.

Char. gen.—This genus differs from Typhlops in the subdivision of its ocular plate into two scales similar to those of the body; the superciliary plate is also undistinguishable from the latter. There appears to be no eyes. Superior labials three.

This genus is between Typhlops and Helminthophis Peters, differing from the latter in its erect nasal plate, with nostril on the superior suture. The Onychocephalus c æ c u s Duméril, from Gaboon, appears to belong to this genus; the two species may be distinguished as follows:

Muzzle obtuse; rostral very wide, largely in contact with the superciliary plates; nasal large .... L. p a l l i d a.

Muzzle transversely acute; rostral not reaching to superciliaries; nasal minute .... L. c æ c a.

Char. specif.—Rostral subquadrate viewed from above, nearly as broad as long, in contact nearly equally with three scales above the fronto-nasals,—viz., the frontal and two superciliaries. The subocular a little larger than the ocular; behind these a series of seven scales from the rictus to the median row, on each side. Preocular and fronto-nasal of equal width, the latter sending a very narrow point to the second labial behind the wider nasal. Nostril very near the rostral suture. Tail as long as width of head, acuminate. Scales equal, in twenty-two longitudinal rows. Form quite slender. Length 6 in. 3·5 lines; diameter at middle 1·25 lines. Color pale flesh-color.

Habitat.—Zanzibar. Presented by C. Cooke to the Essex Institute, Salem, Mass. (Mus. 504.) It was taken from a well. Mus. Acad. Nat. Sci. Philada.

THRASOPS CITRINUS Cope, sp. nov.

Body slender, compressed, tail short for the genus. Gastrosteges rounded and elevated on the sides. Scales in seventeen rows, poreless, *all* strongly keeled; the median more lanceolate; the surface of all finely longitudinally striate. Head quite distinct; muzzle not long, flat, truncate; canthus rostralis straight, angulate, lores plane. Supranasals a little longer than broad; frontal elongate, not concave laterally, occipitals a little longer. Post-frontals descending to labials, no loreal; oculars 1—3. Superior labials nine, fourth, fifth and sixth in orbit, last three longer than high; temporals 1—2. Ten inferior labials, postgenials longer than pregenials.

Total length 23·5 in.; to vent 17 in.; to rictus oris 7 lin.; to orbit 1·5 lin. Gastrosteges 197, urosteges 105.

Yellowish-brown above, gastro- and urosteges rich yellow. Top of head brown, lips paler, the upper edges of the plates light, continuing into a streak to belly.

From the Seychelle Islands; found by U. S. consul Pike. Mus. Acad. Nat. Sciences.

Notes on some points in the Structure and Habits of the Palæzoic CRINOIDEA.

BY F. B. MEEK AND A. H. WORTHEN,

Of the State Geological Survey of Illinois.

Through the kindness of Mr. Charles Wachsmuth, of Burlington, Iowa, we have recently had an opportunity to examine some unique and exceedingly interesting specimens of Carboniferous Crinoids, showing parts of the structure of these animals, in some instances, never before observed, so far as we are at this time informed. In a few instances, these specimens show internal organs entirely free from the matrix, and although like all the other solid parts of these curious creatures, composed of numerous calcareous pieces, really surpassing in delicacy of structure the finest lace-work, and so frail that a touch, or even a breath, might almost destroy them.* Some of these specimens we propose to notice here, but, before proceeding to do so, we avail ourselves of this opportunity to express our thanks to Mr. Wachsmuth for the zeal, industry, skill and intelligence he has brought to bear, in collecting and preparing for study, such an unrivaled series of the beautiful fossil Crinoidea of this wonderfully rich locality. Some idea of the extent of his collection of these precious relics may be formed, when we state that of the single family *Actinocrinidæ* alone, after making due allowance for probable synonyms, he must have specimens of near 150 species, or perhaps more, and many of them showing the body, arms and column.

It is also due to Mr. Wachsmuth, that we should state here that he is not a mere collector only, but that he understands what he collects, and knows just what to collect, as well as how to collect.

Below we give substantially some notes of observations made in his collection, followed by some remarks on other specimens at Springfield:

1. *Synbathocrinus*, Phillips. Some of Mr. Wachsmuth's specimens of a species of this genus show that it is provided with a long, slender, pipe-stem like ventral tube, or proboscis, apparently equaling the arms in length. Also, that a double row of minute alternating marginal pieces extends up within the ambulacral furrows of the arms, apparently all their length. We are not aware that these characters have been hitherto noticed in any of the publications on this genus. It will be seen, however, farther on, that minute marginal pieces probably occupied the furrows along the inner side of the arms of other types of Crinoidea, as well as this.

2. *Goniasteroidocrinus*, Lyon and Casseday. Some unusually fine specimens of the typical species of this genus (*G. tuberosus*) in Mr. Wachsmuth's collection, from Crawfordsville, Ind., show the slender pendent arms much more distinctly than any we had before seen, and from these it seems evident that these arms are stouter than we had supposed, and that there are not more than five or six of them to each of the ten openings. In the specimen figured by us on page 220 of the second volume of the Illinois Reports, these arms were only imperfectly seen by working away, with great difficulty, the hard matrix be-

* By Mr. Wachsmuth's permission, we have prepared for future publication, drawings of all of these instructive specimens.

tween two of the produced rays of the vault, which we have termed pseudo-brachial appendages, or false arms. In clearing away the matrix of this specimen, we had cut just far enough to expose the edges of the arms on each side of the deep ambulacral furrow, so that each of these edges presents the appearance of being a separate and distinct, very slender arm, composed of a single series of pieces, and without any ambulacral furrow on the outer or ventral side; whereas there is a well-defined ambulacral furrow, bearing the tentacula along its margins, on the outer side of the arms, and when the matrix is removed from these ambulacral furrows, the arms can be seen to be composed each of a double series of small alternately-arranged pieces. It is barely possible that in specimens of this species with the arms *perfectly preserved*, that the ambulacral furrows may be covered on the outer or ventral side by a double series of alternating pieces, and that the tentacula* may connect with little openings along each side, though there certainly *appear* to be only open furrows in the specimens examined.

It is worthy of note, in this connection, that there certainly are species, agreeing exactly in all other known characters with this genus, that have no open furrow along the outer or ventral side of the arms, which are distinctly seen to be round on the outer side, and show there a double series of interlocking pieces along their entire length, while the tentacula connect along the inner, or under side, as the arms are seen hanging down. This is clearly seen to be the case in a beautiful specimen of *G typus* (=*Trematocrinus typus*, Hall) in Mr. Wachsmuth's collection, and we can scarcely doubt that in this species there is an open furrow on the inner (under) or dorsal side of the arms. If not, the arms must be tubular, in consequence of having the ambulacral canal inclosed all around, excepting at the points where the tentacula connect along each side.

3. *Cyathocrinus*, Miller. Specimens of this genus showing the vault (more properly the ventral disc) have very rarely been seen. In England a few examples have been found, and these have been supposed to show two openings, one central and another lateral; the latter, according to Prof. Philipps' and Mr. Austin's figures, being provided with a slender marginal tube, or so-called proboscis. Some of Mr. Wachsmuth's specimens, however, of *C. malvaceus* and *C. Iowensis*, Hall, showing the vault, have led us to doubt the existence of a central opening in the vault of this genus, when the specimens have this part entire. The specimen of *C. malvaceus* shows the remains of the usual narrow lateral proboscis, and also has an opening in the middle of the vault, but from the appearance of this opening, as well as from the structure of the vault of a specimen of *C. Iowensis*, in which this opening is closed, we can scarcely doubt that it was also closed in the specimen of *C. malvaceus*, when entire. The remaining parts of the vault of the *C. malvaceus* mentioned consist of only five comparatively large pieces, alternating with the upper inner edges of the first radial pieces,—the one on the anal side being larger than the others, and forming the base of the inner side of the proboscis. These five pieces connect with each other laterally and extend inward some distance, but not so far as to meet at the centre, where there is a subsemicircular opening, nearly as large as that in the remaining base of the proboscis. Along each of the sutures between the five vault pieces mentioned, a comparatively large furrow extends inward from each arm-base to the central opening. These we regard as continuations of the ambulacral furrows from the arms, though there is also a minute opening at each arm base, passing directly downward into the cavity of the body, which was probably for the passage of the arm-muscles.

Looking at this specimen alone, one would naturally suppose there must

* We use the term tentacula here in the sense it is generally used by palæontologists, with reference to the delicate pinnulæ along the arms of Crinoids, and of course not as applying to the minute fleshy organs along the ambulacral furrows, usually termed tentacles by those who have investigated the recent Crinoids.

have been, during the life of the animal, two distinct openings in the vault, as appears to be the case in the specimen of *C. planus*, Miller, figured by Prof. Phillips and Mr. Austin. But on examining the specimen of *C. Iowensis* mentioned above, we find that it shows the base of the small lateral proboscis, with the five principal vault-pieces alternating with the first radials (the one on the anal side being larger than the others), and the same ambulacral furrows extending inwards from the arm-bases, all exactly as in the *C. malvaceus*. But here we find the central opening undoubtedly closed by several vault pieces, while the ambulacral furrows, extending inward from the arm-bases, pass in under these central pieces, and are themselves occupied, or covered, by a double series of alternating, very minute pieces, which probably also extend on, all the way up the ambulacral furrows of the arms as marginal pieces.

From our examinations of these two specimens, which are the only examples of the genus we have seen, showing the vault pieces, and seem to be typical forms of the genus in all other respects, we are strongly inclined to think the specimen of *C. planus*, figured by Prof. Phillips and Mr. Austin, has had these central vault pieces removed by some accident. The fact that these pieces in the specimen examined by us, in Mr. Wachsmuth's collection, seem not to be deeply implanted between the five larger surrounding pieces mentioned, but rather rest, as it were, partly upon the narrow bevelled points of the inner ends of the latter, between the ambulacral furrows, so as tô allow room for these furrows to pass under, would render them less firm, and more liable to be removed by any accident, and may possibly account for their absence in the English specimen mentioned.

In regard to the pieces covering the central part of the vault, and which, from the way they are arranged for the ambulacral furrows to pass under them, were apparently more liable to be removed than the others, we would remark that they do not present the prominent appearance, and uniformity of size and form, of the movable pieces composing what is often called the ovarian pyramid in the Cystids, but certainly have all the appearances of true fixed vault pieces, and scarcely project above the others surrounding them. Consequently we cannot believe it at all probable that this genus had a central mouth, opening directly through the vault; though its ambulacral canals evidently converged from the arm-bases to the middle of the vault, partly above the outer vault pieces, and under those composing the middle of the vault. That these furrows terminated at the entrance of the alimentary canal, under the middle of the vault, as those of *Comatula* converge to the mouth, in the same central position, is highly probable; and, as will be seen further on, we are much inclined to believe that the minute organisms upon which we are led, from analogy, to think these animals subsisted, were conveyed to the entrance of the alimentary canal along the ambulacral furrows, without the agency of any proper mouth, opening directly through the vault. Hence we think it probable that the small tube, usually called the proboscis, situated near the posterior side of the ventral disc, rather corresponds to the tubular anal opening similarly situated in *Comatula Mediterranea*.

From our description of the vault of these species, it will be seen to present considerable similarity to that of *Crotalocrinus rugosus*, excepting that in that genus, owing to its great number of arms, the ambulacral furrows, or canals, bifurcate several times between the middle of the vault and the arm-bases, while in *Crotalocrinus* there is no lateral proboscis, nor, apparently, even any visible opening, judging by the figures we have seen, though we suspect it may have a small opening at the periphery of the ventral disc, on the posterior or anal side. In the group of depressed *Platycrini* for which Troost proposed the name *Cupellæcrinus* we observe a somewhat similar vault, at least in some of the species; also in *Coccocrinus*. In such forms there would seem to be, as it were, an intermediate gradation between the modern Crinoids and the prevailing Palæozoic types, as has been pointed out by Mr. Billings.

4. *Convoluted support of the digestive sack, in the Actinocrinidæ.* The presence

of a large convoluted body, resembling in form the shell of a *Bulla* or *Scaphander*, within the body of several types of the *Actinocrinidæ*, was noticed by Prof. Hall in vol. xli, p. 261 of the Am. Journ. Sci., in 1866, though he made no suggestions there in regard to the functions it probably performed in the internal economy of these animals. In the second volume of the Illinois Geological Reports, published soon after, we figured, on page 191, a specimen of *Strotocrinus*, with this body seen in place, and stated that we regarded it as having been connected with the digestive apparatus of the animal.

Both in Prof. Hall's and our own remarks, this organ was spoken of as a convoluted *plate*. This, however, we now know is not strictly correct, for although composed of hard calcareous matter. and in some species somewhat dense in structure, it seems to be always constructed of a great number of minute pieces, and generally has a more or less open or porous texture; while in some cases it presents the appearance of an exceedingly delicate net-work. It seems never to be attached to the bottom of the visceral cavity, though it extends down nearly to the bottom. It is open at both ends (the opening at the lower end being generally smaller than the other), and is placed with its longer axis nearly so as to coincide with that of the body of the Crinoid. In some species it is more or less dilated at the upper end, while in others it is contracted at both ends, so as to present, as above stated, the form of the shell of a *Bulla*. It has apparently no columella, but is more or less loosely convoluted, with a spiral ridge descending the interior, and sometimes another ascending the exterior. Its walls are generally of moderate thickness, but they often appear to be thicker than natural, in consequence of the presence of inorganic incrustations, of calcareous or silicious matter, which also disguise its real structure.

In *Actinocrinus Verneuilianus*, Shumard, this body is narrow below, and subcylindrical above to the top, which is slightly dilated. The small opening at the lower end has a thickened rim, which passes around spirally, so as to ascend the outside, as a rather stout ridge, all the way to the top, making nearly two turns, and apparently also forming a rim partly around the top. The surface of the whole organ, as well as of its external spiral ridge, has the usual rough appearance, and when fragments of it are held up, so as to be examined by transmitted light, through a good pocket-glass, it is seen to be composed of a great number of very minute polygonal pieces, varying somewhat in form and size. When these pieces are examined under a magnifier, by reflected light, they show shining facets, like crystals, though they are evidently not surface incrustations, but actually compose the walls, or substance of the organ itself. No pores or meshes were observed passing through the walls of this organ in this species, in which it appears to be more than usually dense.

In another specimen in Mr. Wachsmuth's collection, apparently of *Actinocrinus proboscidialis*, this organ, as seen with one or more of the outer turns removed, has an oval or subelliptic form, being contracted and twisted at both ends, so as to present very nearly the appearance of the shell of some species of *Ovulum*. Its walls are quite thin, and seem to form more convolutions than in any other species in which we have had an opportunity to examine it. As seen by the aid of a magnifier by transmitted light, it presents a very beautiful appearance, being composed of a great number of minute pieces, with numerous openings passing through between them. The little pieces and the openings between them, are of nearly uniform size, and arranged so that there are usually one or two of the former intervening between any two of the openings.

Another of Mr. Wachsmuth's specimens of *Actinocrinus securus*, Hall, has one side of the body removed so as to show about two thirds of the convoluted organ, the upper part of which is broken away. The part remaining has a short wide subcylindrical form, with a rather broad, obliquely truncated lower end, which is not tapering, as in the other species. Under a magnifier it is seen to be composed of an extremely fine net-work, far surpassing, indeed, in delicacy of structure, the finest laces that it is perhaps within the power of human skill to fabricate; and as it is entirely free from any surrounding matrix, excepting at one side below, the specimen has to be handled with great care, as a mere touch of this delicate part would probably cause it to fall into hundreds of minute fragments. On examining it under a magnifier, the little bars of which it is composed are seen not to intersect each other at any uniform angle, but anastomose, so as to impart a kind of irregular regularity, if we may so speak, to the form and size of the meshes. Of these little bars there are two sizes, the larger forming the larger meshes, while within the latter a smaller set of processes extend partly or entirely across, so as to form more minute meshes; the whole presenting a beautiful appearance, of which it would be difficult to convey a correct idea by a mere description alone, without the aid of figures.

From analogy, judging from what is known of the internal structure of the recent genus *Comatula*, in which several authors have noticed a reticulated calcareous structure secreted within the tissue of the softer parts of its alimentary canal, we may infer that this convoluted organ was, as it were, a kind of frame work, secreted for the support of the digestive sack, which was probably more or less convoluted in the same way in many, if not all of the Palæozoic Crinoids, though not apparently, in all cases, endowed with the power of secreting a sufficient dense structure of this kind to leave traces of its existence in a fossil state.

So far as we are at this time informed, this organ has yet been very rarely observed in any other family than the *Actinocrinidæ*, though it was probably more or less developed in various other groups. In one instance Mr. Wachsmuth found it in a *Platycrinus*, but here it seems to be, in the specimen found, merely a spongy mass, not showing very clearly the convoluted structure. Some traces of what was supposed to be something of this kind were also observed by him in one of the Blastoids.

5. *Ambulacral canals passing under the vault in the Actinocrinidæ.* In the third and fourth Decades of descriptions and illustrations of the Canadian Organic Remains, Mr. Billings, the able palæontologist of the Geological Survey of the Canadian provinces, gives some highly interesting and instructive remarks on the ambulacral and other openings of the Palæozoic Crinoids. In these remarks he noticed, at length, some striking differences between the vault, or ventral disc, of these older types, and that of the few living examples of this extensive order of animals. That is, he noticed the facts, that while in the living *Comatula* and *Pentacrinus*, the ambulacral canals are seen extending from the arm-bases across the surface of the soft skin-like ventral disc, to the central mouth, and these genera are provided with a separate anal opening, situated excentrically between the mouth and the posterior side, that in the palæozoic Crinoids the ventral disc is very generally, if not always, covered by close-fitting, solid plates, showing no external traces whatever of ambulacral furrows extending inward from the arm-bases; and that in nearly all cases they are merely provided with a single excentric, or subcentral opening, often produced into a long tube which, like the vault, is made up of solid plates. He showed that there is no evidence whatever that the ambulacral canals, in these older types, were continued along the surface of the vault from the arm-bases to the only opening, whether subcentrally or laterally situated, and that in cases where this opening is produced in the form of a greatly elongated proboscis, or tube, such an arrangement of the ambulacra would be almost a physical impossibility. Hence he concluded that the ambulacral canals must have passed directly through the walls of the body at the arm-bases; and he gave several figures of various types, showing openings at the base of the arms, through which he maintained that the ambulacra must have passed to the interior of the body from the arms.

Although these arm-openings had long been well known to all familiar with our numerous types of western Carboniferous Crinoids, in which they are very conspicuous, and we had never entertained any other opinion in regard to them, than that they are the only passages of communication that could have existed between the softer parts occupying the ambulacral furrows of the arms, and the interior of the body, Mr. Billings was the first author, so far as we are at this time aware, who called especial attention to them in this regard. We regret that we have not space to quote a portion, at least, of his remarks on this subject, and would advise the student to read attentively the whole of both of his articles alluded to.

The specimens at Mr. Billing's command enabled him to trace the courses of the ambulacral canals from the arms, through the walls of the body at the arm-bases, and to ascertain the additional fact that, after passing through the walls, they seemed to have turned upward; but beyond this he had not the means of tracing them farther.

A single specimen of *Actinocrinus proboscidialis*, however, in Mr. Wachsmuth's collection, is in a condition (thanks to the great skill of that gentleman, and the exceedingly fortunate state of preservation, by which its delicate internal parts remain almost entire, and without any surrounding matrix) to throw much additional light on this subject. By very dextrous manipulation, Mr. Wachsmuth succeeded in removing about half of its vault, so as to expose the internal parts, in place, and in an excellent state of preservation. The convoluted organ already described in other species is in this comparatively large, subcylindrical in the middle, apparently tapering at the lower end, and a little dilated at the upper extremity. It seems to be rather dense, and shows the usual rough appearance, but as we had no opportunity to examine any detached fragments of it by transmitted light, we did not determine whether or not it has pores passing through it, though it probably has, at least when entirely free from any inorganic incrustation. Its slightly dilated upper end seems to stand with its middle almost, but apparently not exactly, under the middle of the nearly central proboscis of the vault; while at the anterior side of its upper margin, and a little out from under the proboscis, it shows remains of a kind of thickened collar, which we found to be composed of minute calcareous pieces. From this there radiate five ambulacra, composed of the same kind of minute pieces as the collar itself, each ambulacrum consisting of two rows of these minute pieces alternately arranged. They are each also provided with a distinct furrow along their entire length above. As they radiate and descend from their connection with the top of the convoluted framework of the digestive sack, they all bifurcate, so as to send a branch to each arm-opening, those passing to the posterior rays curving a little at first above, so as not to pass directly under the proboscis. These ambulacra, although passing along obscure furrows in the under side of the vault, which are deepest near the arm-openings, are not *in contact* with the vault, or visibly connected with any other parts than the top of the convoluted digestive sack, and the outer walls at the arm-openings. Each of their subdivisions can be traced into an arm-opening, and it is very probable that they continued on out the ambulacral furrows of the arms and tentacula. At one point in one of these ambulacral canals, beneath the vault, some evidences of the remains of two rows of minute pieces were observed alternating with the upper edges of those composing the under side of these canals, and thus apparently covering them over. The condition of the parts is such, however, as scarcely to warrant the assertion that this was really the case, though we are much inclined to think it was. If so, these canals must have been, at least under the vault, hollow tubes, formed of two rows of pieces below, and two above, all alternately arranged.

We are not aware that any evidences of the existence of these delicate ambulacral canals, composed of minute calcareous pieces, and passing beneath the vault from the arm-openings to the summit of the convoluted digestive sack, have ever before been observed in any Crinoid, recent or extinct; and we can but think it probable, that the extremely rare combination of circumstances that brought them to light in this instance may not again occur for centuries to come, with regard to another specimen. That they correspond to the ambulacral canals seen extending from the arm-base to the mouth, on the *outside* of the ventral disc in *Comatula*, is clearly evident.

The presence of furrows radiating from the central region of the under side of the vault to the arm-openings, in various types of palæozoic Crinoids, must have been frequently observed by all who have had an opportunity to examine the inner surface of this part. Messrs. deKoninck and Lehon figure a portion of the vault of *Actinocrinus stellaris*, in their valuable *Recherches sur les Crinoides du Terr. Carb. de la Belgique*, pl. iii, fig. 4 f., showing these furrows, which they seem to have regarded as the impressions left by the muscles of the viscera. The inner surface of the vault of most of our western Carboniferous Crinoids is known to have these furrows more or less defined, either from specimens showing this inner surface, or from natural casts of the same. In some instances they are very strongly defined from the central region outward to the arm-bases, to each of which they send a branch. In *Actinocrinus ornatus*, Hall, for instance, they are generally so strongly defined as to raise the thin vault into strong radiating ridges, separated by deep furrows on the outer side. In *Strotocrinus*, the vault of which is greatly expanded laterally, and often flat on top, these internal furrows, in radiating outward, soon become separated by partitions, and as they go on bifurcating, to send a branch to each arm, they actually assume the character of rounded tubular canals, some distance before they reach the arm-bases.

That these furrows or passages of the inner side of the vault were actually occupied during the life of the animal by the ambulacral canals as they radiate from the top of the convoluted digestive sack to the arm-openings, we think no one will for a moment question, after examining Mr. Wachsmuth's specimen of *Actinocrinus proboscidialis*, which we have described, showing all these parts in place. It is also worthy of note, that in all the specimens of various types in which these furrows of the under side of the vault are well known, whether from detached vaults, or from casts of the interior of the same, they *never converge directly to the opening of the vault, but to a point on the anterior side of it*, whether there is a simple opening or a produced proboscis. The point to which they converge, even in types with a decidedly lateral opening of the vault, is always central or very nearly so, and even when the opening is nearly or quite central, the furrows seem to go, as it were, out of their way to avoid it, those coming from the posterior rays passing around on each side of it to the point of convergence of the others, a little in advance of the opening. That the ambulacral canals here, under this point of convergence of the furrows in the under side of the vault, always came together and connected with the upper end of the convoluted frame-work of the digestive sack, we can scarcely entertain a doubt.

Now in looking at one of these specimens, especially an internal cast of the vault, showing the furrows (or casts of them) starting from a central, or nearly central point, and radiating and bifurcating so as to send a branch to each arm-base, while the opening or proboscis of the vault (or the protuberance representing it in the cast) is seen to occupy a position somewhere on a line between this central point from which the furrows radiate and the posterior side, one can scarcely avoid being struck with the fact, that this point of convergence of the ambulacra, under the vault, bears the same relations in position to the opening of the vault, that the *mouth* of a *Comatula* does to its *anal* opening. And when we remember that eminent authorities, who have dissected specimens of the existing genus *Comatula*, maintain that these animals subsisted on microscopic organisms floating in the sea-water, such as the *Diatomaceæ*, minute *Entomostraca*, etc.,* which were conveyed to the mouth

* Bronn mentions the fact (Klassen des Thierreichs. Actinozoa, II, p. 211), that the remains of *Diatomaceæ*, of the genera *Navicula*, *Actinocyclus Coscinodiscus*, and of minute Entomostraca were found in the stomach of *Comatula*, and suggests that, when such objects, in

along the ambulacral canals, perhaps by means of cilia, we are led from analogy to think that the palæozoic Crinoids subsisted upon similar food, conveyed in the same way to the entrance of the digestive sack If so, where would there have been any absolute *necessity* for a mouth or other opening directly *through* the vault, when, as we know, the ambulacral canals were so highly developed *under* it from the arm openings to the entrance into the top of the alimentary canal? Indeed it seems at least probable, that if the soft ventral disc of *Comatula* had possessed the power of secreting solid vault pieces, as in most types of palæozoic Crinoids, that these vault pieces would not only have covered over the ambulacral furrows, as in the palæozoic types, but that they would also have hermetically covered over the mouth, and converted the little flexible anal tube into a solid calcareous pipe, such as that we often call the proboscis in the extinct Crinoids.

From all the facts therefore now known on this point, we are led to make the inquiry whether or not, in all the palæozoic Crinoids in which there is but a single opening in the vault—whether it is a simple aperture or prolonged into a proboscis, and placed posterially, subcentrally, or at some point on a line between the middle and the posterior side—this opening was not, instead of being the mouth, or both mouth and anus as supposed by some, really the anal aperture alone; and whether in these types the mouth was not generally, if not always, hermetically closed by immovable vault pieces, so far as regards any direct opening through the vault?

We are aware of the fact, that at least one apparently strong objection may be urged against this suggestion, and in favor of the conclusion that the single opening seen in these older Crinoids was the mouth, or at least performed the the double office of both anal and oral aperture. That is, the frequent occurrence of specimens of these palæozoic species, with the shell of a *Platyceras* in close contact by its aperture, either with the side or the vault of the Crinoid, and not unfrequently actually covering the only opening in the vault of the latter, so as to have led to the opinion that the Crinoid was in the very act of devouring the Mollusk at the moment when it perished.

Amongst the numerous beautiful specimens of Crinoids found in the Keokuk division of the Lower Carboniferous series at Crawfordsville, Indiana, there is one species of *Platycrinus* (*P. hemisphæricus*), that is so abundant that probably not less than two hundred, and possibly more, individual specimens of it have been found there by the different collectors who have visited that noted locality; and, judging from those we have seen, apparently about one-half of these were found with a moderate sized, nearly straight, or very slightly arched and conical *Platyceras* (*P. infundibulum*), attached to one side by its aperture, between the arms of the crinoid, and often so as to cover the single lateral opening in the vault of the same.* From the direction of the slight curve of the apex of the *Platyceras*, it is also evident that it is always placed in such a manner, with relation to the Crinoid, that the anterior side of the Mol-

floating in the sea-water, came in contact with the ambulacral furrows of the pinnulæ, they were conveyed along these furrows to those of the arms, and thence in the same way into the mouth. He ridicules the idea, sometimes suggested, that the food may have been handed by the pinnulæ or arms directly to the mouth.

Dujardin and Hupé also state (Hist Nat. des Zoophytes Echind., p. 18), that the living *Comatula* was "nourished by microscopic *Algæ* and floating corpuscles, which the vibratile cilia of the ambulacra brought to the mouth." That they may have sometimes swallowed a larger object, that accidentally floated into the mouth, however, is not improbable, and would not, if such was the case, by any means disprove the generally accepted opinion that these animals received their food almost entirely through the agency of their ambulacral canals.

* We at one time thought these shells attached to the side of this *Platycrinus* to be out of reach of the opening, or supposed mouth, because we had not seen specimens showing the position of the opening in this species, and had supposed, from its similarity to *Platycrinus granulatus*, Miller, and other species without a lateral opening, that such was also the case with this. We have since seen specimens, however, showing that it has a lateral opening, and therefore belongs to the group *Pleurocrinus*, so that it is probable these shells often cover this opening.

lusk was directed upward, when the vault of the Crinoid was turned in that direction.* A species of *Goniasteroidocrinus* (*G. tuberosus*, Lyon and Casseday), found at the same locality, also has frequently a *Platyceras* attached to the top of its nearly flat vault, so as to cover the only opening in the same. It is worthy of note, however, that it is always another, subspiral, *Platyceras* (very similar to *P. æquilaterum*), that we find attached to this Crinoid, so that here at least, it would seem that each of these two Crinoids has its own particular species of *Platyceras*.

In all of these, and numerous other examples that might be mentioned, it is worthy of note that it is to species of Crinoids with a simple opening in the vault, and not to any of those with a produced proboscis, that we find these shells attached in this way;† and it is so rarely that we find shells of any other genus than *Platyceras*, apparently attached to, or in contact with, the body of a Crinoid, that it seems probable where other shells are occasionally so found, that their connection with the Crinoid may be merely accidental. If it could be established as a fact, that these Crinoids were actually devouring these Mollusks, by sucking out, or otherwise extracting and swallowing their softer parts, in any instance where they have been found with a shell attached over the opening of the vault, this would, of course, establish the fact that this opening is the mouth, or, at least, that it must have performed the office of both oral and anal aperture. But to say nothing in regard to all that is known of the habits and food of the recent Crinoids being so directly opposed to such a conclusion, the fact that so large a proportion as nearly one-half of all the individuals of some species should have died at the precise moment of time when they were devouring a *Platyceras*, and should have been embedded in the sediment and subsequently fossilized without separating from the shell, seems, to say the least of it, very improbable.

And it is even more difficult to understand upon what principal an animal with its viscera incased in a hard unyielding shell, composed of thick, close-fitting calcareous pieces, and with even its digestive sack, as we have reason to believe, at least to some extent, similarly constructed, could have exerted such powers of suction as to be able to draw out and swallow, through an aperture in its own shell, often less than one-tenth of an inch in diameter, the softer parts of a mollusk nearly or quite equal in volume to the whole of its own visceral cavity. That they ever did so, however, becomes still more improbable, when we bear in mind the fact, that the animal supposed to have performed this feat, lived, at least during the whole of its adult life, attached to one spot by a flexible stem, that only allowed it a radius of a foot or so of area to seek its prey in; while the mollusk it is supposed to have so frequently devoured, from its close affinities to the genus *Capulus*, may be supposed to have almost certainly lived most of its life attached to one spot.‡ In such a case, why

* Prof. Richard Owen has noticed, in his Report on the Geological Survey of Indiana, p. 364 (1862), the frequent occurrence of a *Platyceras* attached to this same *Platycrinus*, at this locality, and proposed to name the *Platyceras P. pabulocrinus*, from the supposition that it formed the chief food of these Crinoids. It is probable that the *Platyceras* for which he proposed this name, is the same we named *P. infundibulum*, but as he gave no description of the species, and but an imperfect figure, we cannot speak *positively* as to its identity. Prof. Hall has also proposed the name of *P. subrectum* for this Crawfordsville *Platyceras*, but he had previously used the same name for a very different, New York, Devonian species of this genus.

Prof. Yandell and Dr. Shumard have also figured in their paper entitled "Contributions to the Geology of Kentucky," a specimen of *Acrocrinus*, with a very similar *Platyceras* apparently attached to its vault.

Amongst all the numerous Crinoids found at Burlington, Iowa, we are aware of but a single instance of one being found with a *Platyceras* attached, and that is a specimen of *Actinocrinus ventricosus* in Mr. Wachsmuth's collection, which has a crushed shell of a *Platyceras* connected with its vault.

† Possibly due to the fact, that in species with a proboscis there is much less room for attachment to the vault.

‡ Most of the best European authorities on palæontology refer these shells even to the existing genus *Capulus*.

should the Crinoid have so frequently left the *Platyceras* to grow within its reach to nearly its adult size before devouring it? But if from some unknown cause it should have done so, by what means could the Crinoid have pulled loose the Mollusk (which from analogy we may reasonably suppose held with some degcee of tenacity to its place of attachment), and placed it with the aperture of its shell over the opening supposed to be its own mouth? That it could have used its arms and tentacula as prehensile organs, in this sense, is extremely improbable from their very structure, so much so indeed that few if any of the best authorities who have investigated the recent Crinoids, believe that they ever used these appendages to hand directly to the mouth, even minute organisms.*

But we believe the strongest argument against the conclusion that the Crinoids, so frequently found with the shell of a *Platyceras* attached to them, died while in the act of sucking out, or otherwise extracting the softer parts of these Mollusk, remains to be stated. In the first place, if such really was the nature of the relations between the Crinoid and the Mollusk, it is of course self-evident that the continuation of the life of the latter must have necessarily been of very short duration after it came in contact with the Crinoid. Yet we have the most conclusive evidence that such was not the case; but that on the contrary, in most if not all of these instances, the *Platyceras must have lived long enough in contact with the Crinoid to have adapted the sinuosities of the margins of its shell exactly to the irregularities of the surface of the Crinoid.*

We have taken some trouble to examine carefully a number of specimens of *Platycrinus hemisphæricus*, and *Goniasteroidocrinus tuberosus*, from Crawfordsville, Indiana, with each a *Platyceras* attached, and in all cases where the specimens are not too much crushed or distorted, or the hard argillaceous shaly matter too firmly adherent to prevent the line of contact between the shell and Crinoid to be clearly seen, the sinuosities of the lip of the former closely conform to the irregular nodose surface of the latter. Owing to the fact that in some cases the shell has evidently been forced by accidental pressure against the surface of the Crinoid, so as to become somewhat crushed, this adaptation is not always so clearly evident; but in most cases it is more or less visible, while in some it is strikingly manifest. In one instance of a *Platycrinus* now before us, with a *Platyceras* attached, as usual, to its side, between the arm-bases of two of its adjacent rays, and of rather larger size than those usually found attached to this species, the adaptation of the irregularities of its lip, so as to receive the little nodes and other prominence of the Crinoid, is so clearly manifest that a moment's examination must satisfy any one that the shell must have grown there. Being, as we stated, a larger individual than we usually see so situated, it not only occupies the whole of the interradial or anal space to which it is attached, but its lateral margins on each side coming in contact with the arm-bases of the Crinoid, as the shell increased in size, had formed on either side *a profound sinus in its lip for the reception of these arms.* These sinuses are not only in pre-

* In many instances it is clearly evident that it would have been an *absolute impossibility* for certain types of our Carboniferous Crinoids to have handed any object great or small, directly to the only opening through the vault. That is, where this opening is at the extremity of a straight rigid tube, often nearly twice the length of the arms, even to the extreme ends of their ultimate divisions. We are aware that some have supposed this tube, or proboscis, to have been flexible, and the Messrs. Austin even thought it was especially designed and used for the purpose of sucking out the softer parts of Polyps. If flexible, we might suppose that in those cases where it was so much longer than the arms, that it could have been curved so as to bring its extremity within reach of the ends of the arms; but although we have in a few instances seen this tube more or less bent, a careful examination always showed that, where this was not due to an accidental fracture after the death of the animal, it was caused by the plates composing it being on one side larger, or differently formed from those on the other, and evidently not to flexibility. We find the arms, which were evidently flexible, folded and bent in every conceivable manner, but the tube of the vault is, in nine cases out of ten, if not more frequently, when not accidentally distorted, found to be perfectly straight, or a little inclined to one side or the other.

cisely the *proper places*, but of exactly the *proper size and form* to receive the adjacent arm on each side; the entire adjustment being so exact, that it seems scarcely possible that the shell could have been removed during the life of both animals, and after the Mollusk had attained its present size, without either breaking its lip or breaking off the arms of the Crinoid. Unfortunately, in clearing away the rather hard argillaceous matrix, before the arrangement of the parts was clearly comprehended, these arms were broken away, but their stumps are still seen protruding from the sinuses, which are so deep as almost to present the appearance of isolated perforations, though it is evident, on a careful examination, that they are only deep emarginations extending up from the edge of the lip.

In looking at the sides of this *Platyceras*, which has the form of a very slightly arched cone,* and stands out nearly at right angles to the side of the Crinoid, it is easy to see, from abrupt curves in the lines of growth, along up its sides, on a line above the sinuses mentioned, that these sinuses commenced forming abruptly at points about half way up; and on measuring across between these points with a pair of dividers, the space between is found to coincide very closely with that between the inner sides of the arm-bases protruding from the sinuses. Hence it is evident that the shell had commenced forming these sinuses in its lip exactly at the period of its growth, when it had attained a breadth that brought the edges of its lip in contact with the arm-bases. After this, it had increased very little *in breadth* between the arms of the Crinoid, though it had grown somewhat wider above and below, and *nearly doubled its length.* Whether or not it covers the opening in the side of the vault of the Crinoid we are unable to say, since the folded arms (which are, as usual in these cases, well preserved) and adhering matrix, cover the vault. We have scarcely any doubt now, however, that the *Platyceras* does, in this, as in most of the other cases, actually cover the opening in the side of the vault of the Crinoid.

From the facts stated it is, we think, evident that these Mollusks actually lived long enough after their connection with the Crinoids, to which we find them attached, not only to have adapted the edges of their lip to fit the surface of the Crinoid, but to have generally increased more or less in size, and in some instances, at least, to have actually nearly or quite doubled their size. Admitting this to be the case—and we think there can be no reasonable doubt on this point—we can no longer believe that these Crinoids were preying upon the Mollusks; and we therefore think no well grounded arguments can be based upon the fact of their being so frequently found attached in the manner described, in favor of the conclusion that the opening in the vault of these Crinoids is the mouth.

But, if they were not in the habit of eating these Mollusks, it may be asked what could have been the nature of the relations between the two, that so frequently brought them together as we now find them? The first explanation that suggests itself is, that possibly the Mollusk may have been preying upon the Crinoid. But the fact, already stated, that these Mollusks evidently lived long enough attached to these Crinoids, as we have every reason to believe, during the life of the latter, to have at least increased the size of their shells considerably, if not indeed during their entire growth, is alone an almost insurmountable objection to such a conclusion. Doubtless, like other marine sedentary animals, these Mollusks, when very young, floated freely about in the sea, until they found a suitable station to attach themselves, where they remained during life. May they not, therefore, have been attracted to the bodies of Crinoids by the numerous little organisms brought in by the action of cilia, along the ambulacral furrows of the arms of the Crinoids, or in currents produced by the motions of the arms of the latter? The excre-

* It being the common species of *Platyceras* that is usually found attached to this *Platycrinus.*

matious matter of the Crinoid could doubtless have passed out under the foot of the *Platyceras*, supposing the opening in the Crinoid sometimes covered by these shells to have been the anus, but it is difficult to conceive how food could have passed in, if we suppose this opening to be the mouth.

On the Seed Vessels of FORSYTHIA.

BY THOMAS MEEHAN.

Forsythia suspensa Vahl., and *F. viridissima* Lindl., two Chinese plants, have I believe, never been known to produce perfect seed, though common in cultivation. The latter rarely produces capsules; the former bears capsules freely, but no perfect seed.

These two plants have strong specific differences; yet my studies in development, as published in papers in our Proceedings, lead me to believe them to have an unity of origin. Noticing last spring that the stamens in *F. suspensa*, and the pistil in *F. viridissima*, were relatively more highly developed, I supposed the two might possibly be, as we say practically, male and female forms of the same thing. I impregnated flowers of *F. viridissima* with pollen from *F. suspensa*, and for the first time had the opportunity of examining perfect capsules of this species. The seeds, however, though apparently mature, proved imperfect on dissection. There is no doubt but that *F. suspensa* conferred on the other the power to produce capsules,—why not the additional power of perfect seeds is a mystery,—though not more so perhaps than that it should itself be able to produce only seedless capsules. Another form is probably missing, necessary to fertilize the plant and furnish the wanting link to prove the hypothesis of a unity of origin.

But some useful facts proceed from the experiment. The capsule of *F. viridissima* I believe has never been described. Lindley, the author of the species, does not seem to have seen it. It is broadly ovate, sharp pointed, and wrinkled, carpels of a thin papery texture, bivalvate. Seeds resembling small grains of white wheat, wingless, developing upwards a swell as down from the funiculus, shining, and profusely pitted with small dots. The peduncles are rather shorter than the pods. *One capsule was four-celled, with seeds in each division.*

F. suspensa is variously described by different authors. Bunge says the capsule is "about four-seeded," Endlicher "few," and Zuccarini "numerous." The author makes the seeds "narrowly winged." I find the capsule narrowly lanceolate, ligneous, and verrucose, on pedicels double its length, composed of two carpels, in one of which I counted sixteen immature winged seeds; one, however, was fully developed, although as in the other form imperfect, and this *was wingless*, exactly resembling those of *F. viridissima* in all but color, which was a little darker.

The chief interest is the relation these capsules exhibit to Syringa and to the allied orders of Solanaceæ and Jasminaceæ. It was plain in the four-celled capsule of *F. viridissima* that placentous matter pushes out from the central axis in four directions, though usually the *two alternates are destitute of ovules.* When barren it is most highly developed. On perfect seeds it forms no margin; on imperfect ones a wing, until in Syringa, where the productive division bears only a single winged seed, the unproductive one is expanded into a long broad wing, pushing through the whole length of the incurved carpellary margins, cementing them closely together, and thus necessitating the peculiar dorsal dehiscence familiar in the common Lilac. A slight difference in the vigor of placentous development constitutes the chief cause of the differences in these three forms of capsule.

The polyspermous placentation of Forsythia indicates an approach to Solanaceæ, and the erect tendency of the seeds to Jasminaceæ.

Remarks on some types of Carboniferous CRINOIDEA, with descriptions of new Genera and Species of the same, and of one ECHINOID.

BY F. B. MEEK AND A. H. WORTHEN,

Of the Illinois State Geological Survey.

Since the publication of the second volume of the Illinois Geological Reports, in 1866, other engagements have, until recently, prevented us from attempting any further investigations of the Crinoidea, beyond the preparation of some specific descriptions for the third volume. On several occasions we have expressed the opinion, that the classification of these animals, as *entirely* based upon the number and arrangement of the pieces composing the walls of the body below the arms, without regard to the most *extraordinary* differences in other parts, is, to a considerable extent, artificial; and that when larger collections, containing perfect specimens, showing the whole structure of a greater number of species of various types could be obtained for study, considerable modifications in the limits of genera, as most generally understood, would be found necessary. Impressed with this opinion, we separated in the third volume of the Illinois Geological Reports and elsewhere, either as distinct genera, subgenera, or less important sections, various types that had already been named by different parties in this country and Europe, as distinct genera, but which had been almost entirely overlooked or neglected by most authors, while to a few other types we gave, for the first time, distinct names.

Having recently had an opportunity to study in Mr. Wachsmuth's collection at Burlington, Iowa, what we really believe to be by far the most extensive collection of finely preserved Carboniferous Crinoids ever brought together, either in this country or Europe, we have been more than ever impressed, not only with the importance of the separations we had previously admitted, but with the necessity for giving even greater prominence to some of those groups than we have hitherto done, as well as for making other divisions. It is only when we can study a great collection like this, in which specimens may be counted by hundreds, showing the whole structure of numerous species belonging to various genera, that it can be fully realized how readily we may arrange them into perfectly natural groups, distinguished in part by other characters as well as by the structure of the body. In addition to this, in attempting to classify such a collection as this by taking into consideration the structure of the body *only*, we soon find that we would often have to include in a single genus forms differing very widely, on as important *other* characters, as those distinguishing many of the universally admitted genera of other groups of *Echinodermata*.

When once we have become familiar with the different groups, as separated by a careful study of the entire structure of these animals, it is surprising to see how readily we may generally separate them, even from very imperfect specimens, upon some seemingly unimportant characters scarcely ever noticed by those who give the widest limits to genera. That such divisions greatly facilitate the study of these fossils must also be evident to any one who will attempt to identify the numerous species of some allied groups contained in a large collection.

With regard to the new species described in this paper, as well as others that we expect to describe hereafter from the same horizon, it may be proper to state, that we have had the advantage of being able to compare them directly (assisted by Mr. Wachsmuth) with authentic specimens of very nearly all the described species from the Burlington rocks. Many of the original typical specimens we have here at hand in Springfield, while Mr. Wachsmuth has in his own collection good specimens of nearly all the described Burlington species. Many of his specimens are also types of species, while most of those that are not, have been identified from direct comparison by him and Mr. Niles and ourselves, with the original types in the possession of others at Burlington and here.

The fact that Mr. Wachsmuth is the only person (with the exception of occasional visitors) that has been collecting at Burlington during the last four or five years, and that during this time extensive excavations have been made in working the numerous quarries and in opening new streets in the Burlington rocks, has given him great advantages in collecting; consequently his collection may now be regarded as unrivaled in the number and perfection of specimens, as well as in the number of species.

Mr. Wachsmuth informs us that he also has many duplicates that he is willing to exchange for other Crinoids, or to dispose of in any way that may assist in affording him the means of increasing his collection.

Genus CYATHOCRINITES, Miller.

As properly restricted to true typical species, such as the *C. planus*, Miller and *C. mammillaris*, *C. calcaratus* and *C. bursa*, Phillips, the genus *Cyathocrinites* includes forms with a more or less globose (or perhaps rarely obconic) body, composed of thin pieces, which below the vault consist of the basal, subradial and first radial plates, and but a single anal piece that can be properly regarded as forming a part of the walls of the body below the top of the first radials. Of true interradials there are apparently none. The base consists of five pieces, all normally of the same form, and alternating with these there are five generally larger subradials, one of which, on the anal side, differs in form from the others, being truncated above for the support of the only anal piece inserted between two of the first radials. The five first radial pieces are comparatively large and alternate with the subradials all around.

The succeeding radials are all small, more or less rounded, or sometimes angular, and always free or form no part of the walls of the body, those of each ray being distinctly separated by more or less wide interradial spaces. The number of these free pieces varies from two to some six or seven to the ray, the number being generally different in the different rays of the same individual. The arms are slender, more or less bifurcating and rounded or sometimes angular, and always composed of a single series of pieces provided with a deep ambulacral furrow along the ventral or inner side, and apparently without tentacula (pinnulæ) along its margins. The column is generally if not always round and pierced by a small canal, and not divisible into five sections longitudinally.

The vault in this genus is always much depressed, never being extended upward in the form of a *large* poriferous trunk, or so-called proboscis, as we see in the typical forms of *Poteriocrinus*. It is very rarely preserved in the specimens as usually found, but according to Phillips' and Austin's figures of *C. planus* it would appear to be provided with a lateral proboscis, or, more properly as we think, anal tube and an apparent central oral aperture. From specimens of *C. malvaceus* and *C. Iowensis*, however, which we have had an opportunity to examine in Mr. Wachsmuth's collection and have described in another place, we are satisfied that, in these species at least, which appear to be typical examples of the genus, the apparent central opening is closed by vault pieces, in perfect specimens. These central pieces, however, are more liable to be removed by any accident than the five larger surrounding pieces, because the latter are more deeply inserted, in order to permit the five rather large ambulacral canals, extending inward from the arm bases, to pass *over* them, or rather along the upper side of the sutures between them, while these furrows pass in *under* the pieces forming the centre of the vault, which are consequently less firmly fixed.

As we have not had an opportunity to examine the original typical specimens of *C. planus*, figured by Phillips and Austin, we of course cannot assert positively that the vault of these types was constructed like that of the Iowa species we have described, but we are strongly inclined to believe such was really the case, and that the apparent central opening was closed by vault pieces when the specimen was entire.

Of the American species presenting, so far as known, the characters of this genus as properly restricted, the following examples may be mentioned, though the vault of only the first two of these species is yet known to us, viz., *C. malvaceus*, Hall, *C. Iowensis*, Owen and Shumard, *C.* (*Poteriocrinus*) *Barrisii*, *C. viminalis*, *C. lamellosus*, *C, divaricatus* and *C. rotundatus*, Hall; also *C. Saffordi* and perhaps *C. Farleyi*, M. and W., and *C. rigidus*, White.

New species.

CYATHOCRINITES FRAGILIS, M. and W.

Body subsphæroidal, a little oblique, rather regularly rounded to the column below, from near the middle, and a little contracted above; composed of remarkably thin plates. Facet for the attachment of the column not excavated and very small. Base having the form of a very shallow, subpentagonal basin; basal pieces with a general subquadrangular form, but really pentagonal, from the slight truncation of their smaller inner ends at their connection with the column. Subradial pieces comparatively large, hexagonal, excepting the one on the anal side, which is larger than the others and heptagonal in outline. First radial pieces rather smaller than the largest subradials, somewhat wider than high, with a general subpentagonal form; all strongly incurved above between the free radials; facet for the reception of the second radials about one-third the breadth of the first radials and rather deeply excavated. Anal piece rather smaller than the first radials, longer than wide, irregularly hexagonal and supporting the outer side of the ventral tube (proboscis), which, like the body, is composed of very thin plates. Second (first free) radials very small, short and not always extending entirely across the excavation for their reception; succeeding radials, excepting the last, quadrangular, as viewed on the outside, about twice as wide as long, and abruptly rounded or subangular on the outside; last one pentagonal and generally a little longer than the others. Of these free radials four may be counted in one of the posterior rays, six in the other, three in one of the lateral rays, and seven in the anterior ray.

Arms at their origin on the last radials rather divergent, and in one of the posterior rays seen to bifurcate on the sixth piece, above which one of the divisions can be traced to the sixth piece without farther biturcation, though there are probably other divisions beyond; arm pieces about as long as wide, and, like those of the free radials, all deeper than wide, and profoundly grooved within for the reception of the ambulacral organs. Surface smooth or only very finely granular.

Height of body, 0·50 inch: greatest breadth of same, about 0·75 inch.

This species is related to *C. rotundatus*, Hall, but not only differs in having its free radial series much stouter (judging from the facets for their reception in the typical specimen of that species now before us), but in having all of its body plates very decidedly thinner, while its first radials also differ in curving strongly inward, between the bases of the free rays. It likewise comes from the lower division of the Burlington beds, while the *rotundatus* came from the upper, and it has been found that scarcely any of the species are common to those two horizons.

Locality and position.—Burlington, Iowa; lower part of Burlington limestone. Mr. Wachsmuth's collection.

CYATHOCRINITES TENUIDACTYLUS, M. and W.

Body, exclusive of the free rays, deeply cup-shaped, rounded below, composed of moderately thick plates for a true *Cyathocrinus*. Column comparatively rather stout, composed near the base of alternately thin and somewhat thicker pieces, the latter of which project a little and seem to show a slight tendency to become minutely nodular; central canal distinctly pentapetalous in the form of its cross section. Base unknown (being accidentally shoved into the body with the end of the column in the specimen studied). Subradials of moderate size, those seen hexagonal. First radials somewhat larger than the subradials, a little wider than long, with a general subpentagonal form; facet for the reception of the second radials about one-third as wide as the upper side of the plate and excavated about one-third of the way down. Second radial pieces very small, wider than long, and with the succeeding radials curving outward. Third radial in one of the rays nearly as long as wide, expanded above and contracted below, and in this ray surmounted by a fourth, which, like the third in each of the only two other rays seen, is a triangular axillary piece, on which the arms rest, the upper angle being acute and so produced as entirely to separate the arm-bases, while the lateral slopes, on which the arms rest, are distinctly concave. Anal piece unknown.

Arms distinctly divergent at their origin on the last radials, as well as at their succeeding bifurcations, dividing on the third piece in two of the rays seen, and on the fourth in another, the pieces being rounded, nearly as wide as long, somewhat constricted in the middle and a little dilated at their upper ends, while all of the axillary pieces at the various bifurcations have much the same form as the last free radials. Beyond the first bifurcations mentioned, above the last free radials, several of the arms are seen to bifurcate again on the fifth piece and twice to three times more at various distances above, while they all gradually decrease in thickness with each bifurcation until they become much attenuated, though the pieces of which they are composed maintain their length to such a degree that those of the smaller divisions are nearly twice as long as wide.

Surface of body plates slightly beveled at the sutures and more or less roughened by small ridges or nodes, which on the subradial pieces present the appearance of nearly continuous, radiating, somewhat nodulous ridges, while those of the first radials have more the character of irregularly disposed nodes.

Length of body below the top of first radial pieces, 0·40 inch; breadth of same about 0·64 inch; length of arms from their origin on the last radials at least 2 inches and perhaps a little more.

This species seems to be more nearly allied to specimens in Mr. Wachsmuth's collection that have been identified with *Poteriocrinus Barrisi*, Hall, than to any other form with which we are acquainted. It differs entirely, however, in its sculpturing, that species having its body plates marked with numerous, rather fine, thread-like, radiating costæ. The arms, however, are more similar to those of our species, though they are rather stouter below in the latter.

We have not had an opportunity to see the type of *Poteriocrinus Barrisi*, but the form in Mr. Wachsmuth's collection, referred to that species by all the Burlington Geologists, is a true *Cyathocrinus*, or more properly *Cyathocrinites*.

Locality and position.—Lower division of the Burlington beds (Lower Carboniferous) at Burlington, Iowa. Mr. Wachsmuth's collection.

Genus BARYCRINUS, Wachsmuth, MS.

(*βαρύς*, heavy; *κρίνον*, a lily; in allusion to the ponderous nature of the plates and arms.)

Amongst the various American Carboniferous species that have been referred by different authors to the genus *Cyathocrinus*, there is a group of species which, although agreeing with that genus almost exactly in the number and arrangement of the pieces composing the body below the top of the first radials, that still differs in several rather strongly-marked characters. In the first place, these species are all more robust,* and have distinctly thicker and more ponderous plates and arms than in the typical forms of *Cyathocrinus*. They also differ in generally having a more or less developed, quadrangular subanal

* Some of them attain the gigantic size of more than 3·25 inches in breadth of body.

piece, inserted obliquely under one side of the first radial of the right posterior ray, and connecting with the only other anal piece above by a short oblique truncation of its right lower margin. This subanal piece varies in its proportional size, even in different individuals of the same species, and is sometimes very small, or even occasionally wanting, while it is very rarely, if ever, large enough to separate the first radial and the true anal piece above entirely from each other. A more constant difference, however, is the uniform presence of but two of the free primary radial pieces to each ray (instead of an irregular number), excepting perhaps sometimes in the anterior ray, where there may be one or two more. These free radials are also proportionally wider and shorter than in the typical forms of *Cyathocrinus*, particularly the second radial, which is often so short and wide as to present a nearly transversely linear appearance, as seen on the outer side.

As in *Cyathocrinus*, the species of this group have their arms and all their divisions composed each of a single series of pieces, apparently without pinnulæ; but here these pieces are always very much stouter, distinctly rounded, and only provided with comparatively very small, or almost linear ambulacral furrows. Again, they present marked differences in their method of division. That is, instead of regularly dichotomizing, so as to form equal divisions more or less frequently subdividing in the same way, the subdivisions regularly diminishing in thickness, they are often simple from their origin on the last radials, and merely give off along their inner lateral margins, at regular intervals, alternately on opposite sides, stout, rounded, simple armlets. In some instances one arm of each lateral ray, and sometimes one of each posterior ray, dichotomizes once or oftener, but even in these cases the other arms remain simple. and, like the principal branches of those that bifurcate, merely throw off alternately, at regular intervals along their inner lateral margins, stout armlets. If these armlets in this group performed the same offices as pinnulæ in other Crinoids, as we have every reason to believe the ultimate subdivisions of the arms in *Cyathocrinus* proper did, the sacks for the reception of the ova must have protruded considerably beyond the edges of the merely linear ambulacral furrows.

In the column of *Barycrinus* we also observe some more or less defined differences from that of *Cyathocrinus*. For instance, in the former group it is proportionally stouter, with a much larger canal, which is also rarely, if ever, perfectly round, but apparently always obtusely subpentagonal. But the most remarkable difference consists in its being often divisible longitudinally into five sections in *Barycrinus*. This character is not *always* well marked, being apparently sometimes obliterated by the sutures becoming anchylosed. In some cases, however, it is so strongly defined that we find the column with these sutures more or less separated along its entire length, and in some species there were apparently pores passing through these sutures to the cavity within. We are aware that several other types of Crinoids had the column in this way divisible into five parts longitudinally, but we have not seen any indications of it in the typical forms of the genus *Cyathocrinus*.

In regard to the vault of this group nothing is known, not a single individual of the numerous specimens belonging to various species hitherto found, showing, so far as we are aware, any traces of it. From this very fact, however, it seems probable that its vault differed from that of *Cyathocrinus* proper in being merely a soft ventral disc, without any covering of calcareous plates. If it had possessed the power of secreting vault pieces, it seems probable, from the thick ponderous nature of all its other parts, that these would have been sufficiently firm to have been found in place, in some of the numerous specimens now known. In addition to this, the upper inner edges of the first radial pieces, on each side of the free radials, are beveled off to an obtuse edge, and show no facets for the attachment of vault pieces.

Whatever may be thought in regard to this group being entitled to rank as a distinct genus, or as a subgenus, from *Cyathocrinus*, we can only say that the various species of the two groups can be as readily separated, even without specimens showing the arms, as those of any other two allied genera. Indeed, they can be far more readily separated than *Scaphiocrinus* and *Zeacrinus*, or than the former can in all cases be separated from *Poteriocrinus*.

Believing that a systematic classification of the *Crinoidea* really requires the separation of the group under consideration from the types for which the name *Cyathocrinus* was originally proposed, we cheerfully adopt for it Mr. Wachsmuth's appropriate manuscript name, *Barycrinus*. Mr. Wachsmuth refers to this group the following species, the first of which he regards as the typical form,—viz.: *B. spurius*, *B. crassibrachiatus*, *B. bullatus*, *B. tumidus*, *B. magister*, *B. Hoveyi*, *B. latus*, *B. Lyoni*, *B. sculptilis*, *B. Thomæ* and *B. protuberans*, all described by Prof. Hall under the name *Cyathocrinus*; also *B. cornutus* (=*Cyathocrinus cornutus*, Owen and Shumard).

We likewise place in this group our *B. Wachsmuthi*, *B. angulatus* and *B. subtumidus*, all of which were originally described by us under the name *Cyathocrinus*. It is possible our *Cyathocrinus? Sangamonens* may belong here, as it has the same thick body plates, as well as the small quadrangular intercalated subanal piece. Still, as all its first radial pieces are evenly truncated, their entire breadth straight across above, and provided with a transverse furrow, as if for the *articulation* of the second radials, it is probable these and the succeeding radials and arms (which are unknown) had a different structure and arrangement. It is certainly not a true *Cyathocrinus*, however, as properly restricted, but more probably belongs to an undescribed genus.

BARYCRINUS MAGNIFICUS, M. and. W.

Body attaining a gigantic size, cup-shaped, or widening rather rapidly, with moderately convex sides from the column to the top of the first radials. Base shallow, basin-shaped, or about four and a half times as wide as high, with a large concave facet for the attachment of the column, and a large, obscurely five-lobed perforation for the connection of the central cavity of the column with the visceral cavity of the body. Basal pieces regularly pentagonal. Subradial plates about five or six times as large as the basal pieces, as wide as long or slightly wider, all regularly hexagonal, excepting one on the anal side, which is a little shorter than the others, and truncated above for the reception of the anal piece, so as to present a general heptagonal outline. First radial pieces about one-third wider than high, and larger (particularly wider) than the subradials, each presenting a general pentagonal outline, and provided with a rather shallow, outward sloping, concave facet, occupying more than one-third its entire breadth, for the reception of the succeeding radials. Second radial pieces very much smaller than the first, extremely short, or only about one-fourth as long in the middle as wide, and becoming much thinner, or wedge-shaped, on each side. Third radials a little longer in proportion to their breadth than the second, and presenting a subtrigonal outline, supporting on their sloping upper sides, broad, short, rounded arm-pieces. Anal piece about half as wide, and nearly of the same length as the first radials, and subquadrangular in form. Surface marked with small pustules, which often become confluent, so as to produce a peculiar corrugated roughness, somewhat similar to the ornamentation we see on the body plates of the true *Amphoracrinus*, but coarser.

Breadth of body 3·33 inches; height of do., 2·20 inches; breadth of base, 0·60 inch; breadth of facet for the reception of the column, 0·85 inch; do. of largest first radial piece, 1·70 inches; height of same, 1·30 inches. Thickness of one of the arms at base, 0·70 inch.

This splendid Crinoid was found by Mr. Green, of the Illinois Survey, with its plates detached and lying near together in the rather soft matrix. After working out the pieces, we succeeded in building up the entire body to the third radials and first arm-pieces, inclusive, excepting the anal piece, which was not found. It presents a very striking appearance, and is the largest Crinoid we have ever seen. If its arms were as long in proportion as those of some other species of this group, they must have been near twelve inches in length, and with its column, body and arms together, it may have been more than four feet in height. It is evidently related to *Barycrinus magister*, Hall (sp.), but differs from that species, the type of which is now before us, in having its surface roughened by numerous small pustules, showing a tendency to run together into vermicular markings, with an obscure effort, on some of the plates, to assume a radiating arrangement. It is true, the typical specimen of *B. magister* consists of only the basal pieces and a portion of the column, but these basal plates show no traces of the peculiar surface markings seen even on the base of our species, while we have before us, from the same original locality, another specimen of that species, consisting of the whole body, in a flattened and crushed condition, and, although the surface of its plates is well-preserved, they show no indications whatever of the surface markings seen on our species.

Those who give a wide latitude to genera will probably not regard such forms as this as being generically distinct from *Cyathocrinus;* even if that view should ultimately prevail, however, we should insist upon their separation as a strongly marked subgenus, and continue to write the name of our species *Cyathocrinites* (*Barycrinus*) *magnificus.*

Locality and position.—Henderson county, near Biggsville, Illinois; from the Keokuk group of the Lower Carboniferous.

Barycrinus Hoveyi, var. Herculeus.

Amongst other Crinoids from Crawfordsville, Indiana, we have before us several very large, fine specimens, agreeing well with Prof. Hall's description of his *Cyathocrinus Hoveyi* (Bost. Jour. Nat. Hist. vol. vii, p. 293), excepting in some important points in the structure of the arms. We suspect that these specimens are specifically distinct, but as neither any measurement, nor figures of the *C Hoveyi*, have yet been published, we cannot feel quite sure of this, and therefore place them, provisionally, as a variety of the species *Hoveyi*, under the name *Herculeus*, which we propose to retain for the species if the differences to be noted are found to be constant, and of specific value.

The differences to which we allude are the following: In *C. Hoveyi* the arms of the antero-lateral rays are said to "have the anterior division twice bifurcating, above which the divisions give off branchlets, and the same feature marks the entire length of the lateral arm of the antero-lateral ray, which is smaller than the other." In the specimens before us, the anterior lateral rays have each the *posterior* division bifurcating *once* near the base, while the anterior division is *simple*, and *larger*, instead of smaller, than the other. Again, the *Hoveyi* is said to have, "in the postero-lateral arms, the lateral division of the rays bifurcating on the fourth piece, above which branchlets are thrown off, as in the others." In the specimens before us, however, *both* arms of the posterior rays are, like those of the anterior ray, and one of each lateral (or anterior lateral) rays, simple from their origin on the third radials, very long, stout, and give off along their inner lateral margins stout, simple armlets, alternately at regular intervals. As we have seen several specimens all agreeing in these characters, we are inclined to think this may be a specific difference.

In one of the specimens before us the body measures 1·10 inches from the base to the top of the first radials, and about 1·40 inches in breadth. The arms show a length of 4 inches, and are broken at the ends, so as to appear to have been, when entire, nearly one inch longer. They are very straight, nearly cylindrical, and measure 0·22 inch in diameter near the middle, where each arm-piece measures about 0·15 inch in length, and the lateral armlets nearly the same in diameter.

Genus NIPTEROCRINUS, Wachsmuth, MS.

(*νιπτήρ*, a washing vessel; *κρίνον*, a lily; in allusion to its basin-shaped body.)

Mr. Wachsmuth has proposed the above name, in manuscript, for a type agreeing with *Cyathocrinus* proper in the thinness of its body plates, in the nature of the bifurcations of its arms, and apparently in the general structure of its body, excepting that it has no anal plate, the first radials being large, wide. and in contact all around, so as to leave no spaces for anal or interradial pieces. The succeeding radials after the first are comparatively small, and number from three to four (so far as yet known) to each ray, the first always resting in rounded sinuses in the upper edge of the large first radials, much as in *Cyathocrinus*, excepting that these free radials are very short, more as we see in *Barycrinus*. They differ, however, from those of both *Cyathocrinus* and *Barycrinus*, in each having its lower edge along the outer side of the arms produced downward, into a corresponding sinus in the upper outer edge of each succeeding piece below, so as to present much the appearance seen in the arms of *Taxocrinus*, *Onychocrinus* and *Forbesiocrinus*, excepting that the produced part does not seem to be separate patelliform pieces, but merely the downward produced lower outer edge of each arm-piece itself.

None of the specimens yet found show the *number* of basal pieces, but we can see that its body is composed of small basals, with five well-developed subradials of uniform shape, and five large first radials. This structure of the body, it will be seen, is exactly that of *Erisocrinus*,—that is if the base is composed of five pieces, which is very probable. The whole structure and aspect of the parts above, however, is entirely different in these groups, since in *Erisocrinus* there are always but two primary radial pieces to each ray, while the second radials are as large as the first, and instead of merely resting in small sinuses in the upper part of the latter, the two *articulate* together by straight edges across their entire breadth, the articulating edges being always provided with a crenated transverse ridge and furrows. The arms of *Erisocrinus* are also much stouter, and present none of the characters of the type under consideration, while all of its body and arm pieces also differ in being very thick.

It is an interesting fact that the column of the genus here described, as well as its arms, present a striking similarity to that of *Taxocrinus* and allied groups, being round, and composed near the body of exceedingly thin pieces, connecting by crenate surfaces, and provided with a comparatively small central canal. Notwithstanding these points of resemblance, however, to *Taxocrinus*, it is evident that this group is more nearly allied to *Cyathocrinus*. If it has, as seems to be the case, five basal pieces, the formula of the genus would be as follows:

Basal pieces 5; subradials 5, all of the same form; radials 4 to 5 $\times$ 5, the first being large and forming the larger part of the body, the others small and free; anals 0; interradials 0; arms bifurcating, and resembling those of *Taxocrinus*.

Some five or six specimens of this type show that the absence of anal pieces is not an abnormal, but a constant character.

Nipterocrinus Wachsmuthi, M. and W.

Body rather deeply basin-shaped, or a little more than twice as wide as high, rounding under from the top of the first radials to the column. Base small, flat, and nearly hidden by the column. Subradial pieces of moderate size, somewhat wider than long, and all pentagonal, there being no visible angle at the middle of the under side of any of them. First radials comparatively very large, or about three times the size of the subradials, twice as wide as high. and all alike pentagonal; while each is provided with a rather deep rounded sinus above, equaling about one-third of its breadth, for the reception of the succeeding radials, on each side of which its upper margin is nearly straight, horizontal, and not incurved. Second radials so short as scarcely to fill the sinus in the upper side of the first, and owing to the concave outline above, often presenting a narrow transversely crescentic form. Third and fourth radials (where there are five) very short, or several times as wide as long, and usually somewhat arcuate inversely. Last (fourth or fifth) radials a little longer than the next below, and generally trigonal or subpentagonal (the upper angle being somewhat salient), and supporting the arms on its sloping sides. Arms rounded, rather divergent, and bifurcating on the sixth or seventh piece above their bases, and again once or oftener farther up, the divisions above each bifurcation being about half as large as the main arm below; arm-pieces about twice as wide as long, not wedge-shaped, but all showing the downward curvature quite distinctly, and slightly constricted on each side. Surface merely finely granular, and the plates of the body neither beveled nor tumid. Column composed of such thin pieces that about fifteen of them may be counted in a length equaling its own thickness, near the base.

Height of body of the largest specimen to top of first radials, about 0·43 inch; breadth near 1 inch.

Thickness of column of same, near base, 0·20 inch; diameter of its subpentagonal canal, 0·05 inch.

This Crinoid is so unlike all others known to us, that it is scarcely necessary to compare it with any of the described forms. The specific name is given in honor of Mr. Charles Wachsmuth, the author of the genus, to whom we are indebted for the loan of the typical specimens.

Locality and position.—Upper Burlington beds of the Lower Carboniferous. Burlington, Iowa.

Mr. Wachsmuth's collection.

Genus CATILLOCRINUS, Troost.

CATILLOCRINUS BRADLEYI, M. and W.

Body small, basin-shaped or rather broadly truncated below for connection with the column, and moderately expanding upward to the top of the radials supporting the arms. Lower series of plates visible around the top of the column, anchylosed together, and presenting the form of a broad low dish, many times wider than high, with the margins sinuous above for the reception of the next range of pieces. Succeeding range of plates presenting the usual irregular form of the genus, two of them being much larger than the others, very wide at the top, and supporting nearly or quite all of the arms; between these on one side there is a much smaller triangular piece on the same range, and extending up as high as the others, but so narrow at the top that it could not have supported more than one or two, if any, of the small arms. On the opposite side there are two other small intercalated pieces, the smaller of which is triangular and scarcely extends up to the top of the cup, while the other is oblong, extends to the top of the cup, and supports either another somewhat smaller (anal?) piece above, or the base of an arm much larger than the others. Arms about 44, in contact at their bases, and all slender and composed of joints two or three times as long as wide. Surface smooth. Column comparatively very large (circular?), with a large round central canal, and composed near the base of rather thin pieces of uniform size.

Height of body, 0·18 inch; breadth at top, 0 24 inch; breadth of column at the base of the body, 0·13 inch.

This species will be at once distinguished from *C. Tennesseæ* of Troost by its much smaller size, and smooth instead of coarsely granular plates. It is much more nearly allied to our *C. Wachsmuthi*, from the Burlington group, but ₍body is less expanded at the top, and it also differs in having a comparatively large anal? piece, or larger arm, between the others on one side. Named in honor of Prof. Frank H. Bradley, of Hanover College, late of the Illinois Geological Survey, who discovered the only specimen known.

Locality and position.—Crawfordsville, Indiana; Keokuk division of Lower Carboniferous series.

Genus DICHOCRINUS, Munster.

DICHOCRINUS EXPANSUS, M. and W.

Body expanding rather rapidly from the facet for the attachment of the column, to the top of the base, and still more rapidly from there to the top of the first radials, so as to make the breadth at the latter point about twice the height. Base forming less than half the height of the body, somewhat basin-shaped, though narrow below, or ornamented with small irregular wart-like nodes, which show some tendency to form three or four vertical rows, or ridges on each basal piece. First radial pieces comparatively large, somewhat oblong in form, being longer than wide, with the widest end above, all convex along up the middle, and strongly beveled, or excavated along the sutures on each side,—while the surface of each is ornamented with small, irregular, wart-like nodes, similar to those on the base; these sometimes coalesce into irregular ridges, but are usually arranged in three rows, starting from the most prominent upper end of the plates, and radiating to the base; facet for the reception of the second radial pieces about one-third the breadth of the upper end of the plates, and somewhat excavated. Anal piece of much the same size, and general nodose appearance as the first radial on each side, but somewhat longer, and having an irregular hexagonal form. Second radial pieces small, about twice as wide as long, and more or less quadrangular in form. Third radials slightly larger than the second, with a pentagonal form, the upper sloping sides supporting the first division of the arms.

Arms rounded, composed at first of pieces about as long as wide, upon the second or third of which they bifurcate, the outer divisions remaining simple, and the inner ones bifurcating again on the second or third piece, the outer division, as before, remaining simple, and the inner bifurcating a third time on the second pieces, thus making in the posterior rays (the only ones seen) eight arms to each ray, or forty in the whole series, if other rays have the same number. All the simple arms are long, slender, rounded, and but slightly tapering; near their bases they are each composed of a single series of somewhat wedge-formed pieces, but gradually pass into a double series of minute interlocking pieces.

Breadth of body, 0·98 inch; height about 0·43 inch. Length of one of the simple arms, about 1·60 inches; thickness of same at base, 0·05 inch.

Associated with the specimen from which the foregoing description was drawn up, several other imperfect examples were found, differing more or less in form and in the arrangement of their ornamentation, which either indicate considerable variations in these characters, or the existence of several allied species. One of these has the first radial and anal plates more abruptly spreading, and proportionally wider than in the typical form, while its nodes are more coalescent, so as more generally to run into continuous ribs. On the base, for instance, each of the two plates has three somewhat nodulous vertical ridges, with intervening rows of the little nodes, while the three rows of nodes on the first radial and anal pieces often run together so as to form mere nodulous ridges. It is possible this would be found to be a distinct species, if we could examine a specimen showing the arms. If so, it may be called *D. stelliformis*, in allusion to the star-like appearance produced by its spreading first radial pieces, with their little ridges running outward and converging to the outer extremity of each.

In another individual the nodes and ridges are all nearly obsolete, excepting a few of the former, which are very prominent at the middle of the outer ends of the first radials; while another has a single prominent node near the small facet in each first radial, for the reception of the second, with a few irregularly scattering nodes on other parts, and slender, obscure, nodular ridges near the lateral margins. From the general appearance of these specimens, we are rather inclined to the opinion that they are all varieties of one variable species.

Locality and position.—Same as last.

Genus DORYCRINUS, Roemer.

In the second volume of the Reports of the Geological Survey of Illinois, we distinctly recognized the *Dorycrinus* group as forming a well-defined genus, clearly separated from *Actinocrinus* (as properly restricted), to which genus they have generally been referred; but owing to the fact that at that time we had never seen either a specimen or a figure of an *Amphoracrinus* showing the arms, body, and parts connected with the opening of the vault, all preserved together, we were under a misapprehension in regard to the true characters of that group, and consequently placed *Dorycrinus* as a synonym under it. Recently, however, we have been so fortunate as to see in Mr. Wachsmuth's extensive collection beautiful specimens of both types, in a remarkably fine state of preservation, and from these we are satisfied that a systematic classification of the *Crinoidea* requires these two groups to be separated as distinct genera.

In the first place, it may be proper to remark that in both of these groups the structure of the body, so far as regards the number and arrangement of the pieces below the arm-bases, is almost exactly the same as in *Actinocrinus*.* The structure of the parts above, however, is very different. For instance, in *Dorycrinus* the opening of the vault is never at the end of a more or less prolonged tube, or so-called proboscis, nor even in the slightest degree proboscidiform, but is merely a simple aperture penetrating a somewhat thickened protuberance, and nearly always situated and opening laterally. The vault in this group is generally provided with a more or less prominent spine over each ray, and a sixth one in the middle. Sometimes these are all, or in part, merely represented by nodes, or even in some instances nearly obsolete, while in others they are extravagantly developed. Again, *Dorycrinus* differs from both *Actinocrinus* and *Amphoracrinus* in having, so far as yet known, always *two arms springing directly from each arm-opening, and these arms always simple.* Our attention was first called to this by Mr. Wachsmuth, who is a very careful and accurate observer, and we found it to be so in all the specimens in his collection, while he assures us that this is the case in all the specimens found by the various collectors at Burlington, as well as all of those he has yet seen from other localities, with the arms attached. Hence in all of the species of this group described by Prof. Hall and others, where the number of arms has been given from merely counting the arm-openings,—and specimens of these have since been observed with the arms attached,—their number is found to be *just double that stated in the descriptions.* It is also worthy of note that in this group the body plates are either plane, more or less tumid, or tuberculiform, and never marked with proper radiating costæ, as we often see in *Actinocrinus*.

The following is a list of the described species belonging to this group, all of which are, so far as known, exclusively American types, and confiued to the Lower Carboniferous, viz.: *Dorycrinus Mississippiensis*, Roemer, and *D. Gouldi*, † *D. cornigerus*,* *D. divaricatus*,* *D. trinodus*, *D. quinquelobus*,* *D. symmetricus*,* *D. desideratus*, *D. unispinus*,* and *D. subaculeatus*, Hall (sp.), all of which were described by Prof. Hall under the name *Actinocrinus*. It likewise includes *D. Missouriensis** (= *Act. Missouriensis*, Shumard) and *D. unicornis** (= *Act. unicornis*,‡ Owen and Shumard), as well as our *D. subturbinatus*,* originally described as an *Actinocrinus*.

It might at a first glance be supposed also to include *Actinocrinus corniculus* and *A. brevis* of Hall, but these forms (which Mr. Wachsmuth's collections clearly show to be only varieties of one species) have but a *single* arm from each arm-opening (two to each ray), and these arms with the proportional stoutness, general structure, and broad pieces at their bases, of *Agaricorinus*. Hence this species can only be regarded as a somewhat aberrant form of the latter genus.

To the genus *Dorycrinus* we also refer the following new species:

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* *Dorycrinus*, however, differs from *Actinocrinus* in having the second radial pieces nearly always short and quadrangular, instead of hexagonal.

† Specimens of all the species marked with an asterisk have been found with the arms attached, and presenting the characters mentioned above. The arms of the others remain unknown.

‡ The proposed species *A. tricornis* and *A. pendens*, Hall, are believed to be only varieties of *unicornis* of O. and S.

DORYCRINUS ROEMERI, M. and W.

Body somewhat urn-shaped, being obconical below the arms to the truncated base, and moderately prominent above, the vault forming rather more than one-third of the entire height; greatest breadth at the arm-bases. Base truncated and somewhat concave below, about twice as wide as high, slightly expanded and a little angular below, with broad, rather shallow notches at the sutures. First radial pieces about twice and a half as wide as high, two heptagonal and three hexagonal, each one swelling out so as to form a moderately prominent, rather obtuse, transversely elongated node. Second radials one-third to nearly one-half as long as the first, quadrangular, a little wider than long, and more or less tumid. Third radials rather larger than the second, wider than long, pentagonal, hexagonal and heptagonal; each one supporting on each of its superior sloping sides a pentagonal secondary radial, of rather smaller size, each of which in the posterior rays supports, in its turn, on each side above, one, or sometimes two, brachial pieces, making four arm-openings to each of these rays. This seems to be the case also in the right lateral ray, while one of the secondary radials, in the specimen studied, appears to be merely truncated, so as to support (perhaps abnormally) only one brachial piece, thus making only three arm-openings to this ray. The brachial and secondary radial pieces of the anterior ray are broken away in the specimen, but it is probable there were four arm-openings in this ray. If so, there would be nineteen arm-openings (probably normally twenty) in the entire series, and thirty-eight to forty arms, counting two to each opening.

First anal piece of the same size and form as the first radials, and, like them, swelling out into a transversely elongated node. Above this there are two heptagonal, and one apparently hexagonal, rather tumid pieces in the second range, and above the latter several other pieces extending up between the arm-bases, so as to connect with a series of pieces forming a thickened protuberance rising even slightly higher than the summit of the vault, and pierced by the anal opening, which is situated considerably above the horizon of the arm-bases, but still directed laterally. Interradial pieces three to each area, the first being about half as large as the subradials, heptagonal or octagonal, and supporting two somewhat elongated irregularly formed pieces that are scarcely convex, and connect, by their narrow upper ends, with vault pieces above. Vault somewhat rounded, with lateral spines very short, or merely having the form of rather prominent conical nodes; central piece somewhat tumid, but not even conical. Arms and column unknown.

Named in honor of Dr. F. Roemer, the founder of the genus *Dorycrinus.*

Height of body to top of vault, 1·40 inches; do. to top of anal protuberance, 1·45 inch; breadth at arm-bases, 1·30 inch; breadth of base, 0·55 inch.

This species is perhaps more nearly allied to *D. Missouriensis*, Shumard (sp.) than to any other yet known. It will be readily distinguished, however, by several well-marked characters. In the first place, its base is not thickened and expanded as in that species. Again, its vault is not so flattened on top, nor the spines, or tumid pieces over the rays, near so large. In the *Missouriensis* the latter character is so strongly marked as to place the widest part of the body above the arm-bases, which consequently have the appearance of being attached half-way down the sides of the body, while in the species under consideration the body is distinctly wider at the arm-base than above. Our species also has seven or eight arms more than Dr. Shumard's.

Those who prefer to view the *Dorycrinus* group as only a section of *Actinocrinus* will, we hope, at least write the name of this species *Actinocrinus* (*Dorycrinus*) *Roemeri.*

Locality and position.—Upper part of the Burlington beds, of the Lower Carboniferous series, at Burlington, Iowa. No. 127 of Mr. Wachsmuth's collection.

DORYCRINUS QUINQUELOBUS, var. INTERMEDIUS.

On comparing this form with the typical specimen of *D. quinquelobus* (=*Actinocrinus quinquelobus*, Hall, Supp. Iowa Geol. Report, vol. i, p. 15), we find that it agrees very closely in the structure of its body, as well as in the number of arm-openings to each ray (that is, four to the anterior and each posterior ray, and two in each of the lateral rays), but at the same time it presents some other differences, that we suspect may be even of specific importance. In the first place it is larger and more robust. and has a proportionally smaller base, and rather distinctly tumid, instead of even body plates, while its interradial and anal spaces are not near so deeply excavated between the arm-bases as in the type of *quinquelobus*. Its third radial pieces also differ in form, being so narrow in all the rays as to let the secondary radials come in contact with the first interradial and the second range of anal pieces, instead of extending around so far laterally as to separate these pieces. Its vault is likewise more flattened on top.

In the typical specimen of *D. quinquelobus* the spines of the vault have all been accidentally removed, but in the form under consideration they seem to have been short and stout, though their entire length is not known, as they were apparently broken off during the life of the animal, since they each have the broken end somewhat rounded and indented in the middle. In size and general appearance it is more like *D. Mississippiensis* of Roemer, but it differs in having rather more tumid body plates, as well as in the number of the arm-openings, that species having four of these openings to each ray all around. It also has a more protuberant anal opening, and probably had much shorter vault spines. It therefore seems to be somewhat intermediate between the *D. Mississippiensis* and *D. quinquelobus*, but is probably distinct specifically from them both. As we have but a single specimen, however, of it, and the typical specimen of *D. quinquelobus* for comparison, we prefer to place it, for the present, as a variety of that species, under the name *intermedius*, and if it should hereafter be found that the differences we have pointed out are constant, it can take the name by which we have proposed to distinguish it as a variety, as a specific name.

Locality and position.—Upper part of the Burlington division of the Lower Carboniferous series, at Burlington, Iowa. No. 164 of Mr. Wachsmuth's collection.

Genus AMPHORACRINUS, Austin.

As already stated, this group agrees with *Actinocrinus* in the number and arrangement of the pieces composing the under side of the body, as well as in having the parts adjacent to the arm-bases forming five projecting lobes, distinctly separated from each other by the anal and interradial sinuses. It differs from them both, however, in the structure of the parts above, as well as in having the body generally more depressed, or even flat below, and the vault proportionally more ventricose; while its second radial pieces are more generally hexagonal than in *Dorycrinus*. From the latter it also differs in having the opening of the vault more or less probosciform,* and placed nearly half way between the middle and the anal side, instead of being a simple generally lateral aperture, penetrating laterally a merely thickened protuberance. The probosciform extension of its vault, however, is never so long and slender as we usually see in *Actinocrinus*, and also often differs in being crowned with small spines surrounding the very small terminal aperture, which seems always to open *upward*. As in *Dorycrinus*, the vault is generally more or less spiniferous, though the spines are differently arranged, and, as far as yet known, never so extravagantly developed as we sometimes see them in that

* In all the foreign specimens of the typical species of *Amphoracrinus* that we have seen, only the broken base of this short proboscis remains; and this also seems to have been the case with nearly all those from which the published figures which we have had an opportunity to examine, were drawn Cumberland, however, has given a figure in his Reliquiæ Conservatæ, (pl. C.), apparently of the typical species *amphora*, with the short oblique proboscis well preserved. This will be seen to differ materially from the merely slightly protuberant thickening in which the opening in *Dorycrinus* is situated.

group. Some of the species are known to have one of the vault pieces over each ray more or less protuberant, and it may be the case that species existed in which those were developed into spines, somewhat as in *Dorycrinus*, though we are not aware that any such have yet been found. Near the middle of the vault there is also a large tumid piece, sometimes developed into a short spine, while around the anterior side of this, four or five similar pieces are semi-circularly arranged, which also often become well developed spines.

We have never seen any figures or specimens of the European typical species of *Amphoracrinus* showing the arms, but there are in Mr. Wachsmuth's collection several beautiful specimens, found at Burlington, agreeing exactly in all other characters (not merely specific) with the types of the genus, in which the arms are perfectly preserved. In these we observe marked differences, both from *Dorycrinus* and *Actinocrinus*. For instance, in *Amphoracrinus divergens* (= *Actinocrinus divergens*, Hall), the arms, although *bifurcating so often as to form altogether about fifty-three or more divisions, they* are each, as well as each of these divisions, composed of a double series of very short alternating pieces *all the way down, even below all the bifurcations to their very bases*, with the exception of one to two or three simple brachial pieces, at the origin of each main arm on the last primary or secondary radials.

The structure of the arms, it will be seen, is the same as in *Saccocrinus* (an otherwise different type), but widely different from what we see in *Actinocrinus*, in which the arms are always composed of a *single series* of pieces *below* such bifurcations as take place. It is also even more decidedly different from that of *Dorycrinus*, in which the arms not only never bifurcate in any of the species in which they are known, but are also arranged so that two of them spring directly from each arm-opening without imparting to the brachial piece on which they rest the usual form of an axillary piece.

In one species, however, (*Actinocrinus spinobrachiatus*, Hall), having apparently all the other characters of *Amphoracrinus*, the arms do not bifurcate after their origin on the axillary secondary radial pieces. It seems, therefore, probable that there are some species of this group with simple arms, and others that have them more or less frequently bifurcating. The probability is, however, that in *all* cases when they *do* bifurcate, that they are equally composed of a double series of small alternating pieces *below* the bifurcations as well as above, the same as in the species *divergens*. Whether we include such species as the *spinobrachatus*, however, with merely *simple arms*, composed like the others of a double series of alternating pieces throughout their entire length, as a separate section of *Amphoracrinus*, or view them as forming a distinct group, they need not for a moment be confounded with *Dorycrinus*, from which they not only differ in form, surface markings, opening of the vault, &c., but also in never having two arms springing directly from each arm-opening.

In all the species of *Amphoracrinus* known to us, either foreign or American, it is also worthy of note that the surface of the body plates is never ornamented with proper radiating costæ, such as we often see in *Actinocrinus* and other allied types, nor yet smooth, or properly tuberculiform, as in *Dorycrinus*, but always presents a peculiar vermicular style of sculpturing or corrugation difficult to describe, but very characteristic and easily recognized again after being once observed.

To this group Mr. Wachsmuth has, in MS., correctly referred the following American species, viz: *Amphoracrinus divergens*, *A. planobasalis*, *A. spinobrachiatus?* and *A. inflatus*, described by Prof. Hall, under *Actinocrinus;* also *Actinocrinus quadrispinus*, White; all from the lower division of the Burlington beds.

AMPHORACRINUS DIVERGENS, Hall, (sp.)

Actinocrinus divergens, Hall, Supp. Iowa Report, p. 36, 1860.

This species was apparently described by Prof. Hall from imperfect specimens, showing only a few of the lower bifurcations of the arms, since he thought it probably had only twenty-two arms, while perfect specimens in Mr. Wachsmuth's collection show that they continued bifurcating farther up, so as to make the whole number about fifty-three or more, as already stated in another place.

Amongst Mr. Wachsmuth's specimens there is one (No. 136) with arms, body, vault and proboscis all in a remarkably fine state of preservation, which appears to agree very closely with the *A. divergens* in most of its characters, and yet differs in several respects. It has very nearly the same number of ultimate divisions in the entire series of arms, though there are differences in the details of their mode of divisions, so that the number of arms in any one of the rays is different from what we see in the corresponding ray of *A. divergens*. In each of its posterior rays there are, as near as can be made out, thirteen to fifteen arms; in one of the lateral rays and the anterior one, each eight, and the other lateral one eleven or twelve. Its ventral tube (proboscis) is rather stout, about one inch in length, and crowned by some six or seven small unequal spines, subspirally arranged. At the anterior side of the base of the proboscis, and nearly at the centre of the vault, there is a large tumid piece, and on each side of this a spine about three-fourths of an inch in length, directed obliquely outward, upward and forward, and in front of these two other prominent or subspiniform pieces. In the typical *A. divergens*, these two anterior lateral larger spines each *bifurcate*, while in the specimen under consideration they are *simple*. The usual vermicular markings of the body plates in the specimen are well defined, and on the upper anal and vault pieces, as well as on those composing the proboscis, and even on the spines, the whole surface of which is occupied by rather coarse granules. As in the other species of this group, the arms of which are known, they extend at their bases, first horizontally outward, or even a little downward, and then curve upward.

It is probable that this specimen, with simple instead of bifurcating vault spines, and somewhat differently divided arms, may be specifically distinct from the *A. divergens*. If so, we would propose to call it *Amphoracrinus multiramosus*.

Genus BATOCRINUS, Casseday.

From deference to the most generally prevalent opinions of palæontologists, we have elsewhere included *Batocrinus* as a subgenus under *Actinocrinus*, though we did so with a protest, stating that we were strongly inclined to view it as a distinct genus. Our recent study of Mr. Wachsmuth's extensive collections has still more decidedly impressed us with necessity for separating these groups generically.

As we have in other places stated the genus *Batocrinus* presents no essential difference from *Actinocrinus* in the number and arrangement of the pieces composing the walls of the body below the arms, nor in the vault and its elongated central or subcentral tube, though its second radial pieces generally differ in being proportionally shorter and quadrangular, instead of hexagonal or pentagonal. One of the most obvious differences, however, consists in the arrangement of the brachial pieces and adjacent parts, which in *Batocrinus* form a nearly or quite continuous series all around, instead of being grouped into five protuberant lobes, separated by more or less wide and deep interradial and anal sinuses. Again, in *Batocrinus* the arms never bifurcate as we often see in *Actinocrinus*, all the divisions of the rays taking place in the walls of the body below the brachial pieces; while the arms, (which in all cases yet known, with one exception, spring singly from each arm-opening), are generally much shorter in proportion to the length of the proboscis, which often projects from one-third to one-half its entire length, beyond the extreme ends of the arms. Another difference is to be observed in the surface of the body plates, these pieces never being sculptured or ornamented with radiating costæ, as is often seen in *Actinocrinus*, but merely even, more or less tumid, or tuberculiform. The vault pieces in *Batocrinus* are also generally tuberculiform, or sometimes produced into short spine-like projections, but even where they assume the character of spines they never have the regularity of arrangement, nor do they ever attain the length we often see in *Dorycrinus* and *Amphoracrinus*. The species of *Batocrinus* also present a much greater diversity of form than we see in *Actinocrinus*, since we find amongst them every variety of shape, from globose to turbinate, biturbinate, pyriform, discoid, and even in some rare aberrant types apparently belonging here, a conical or stelliform outline.

The species of this genus may be variously grouped to facilitate their study into sections and subsections, based upon their differences of form, and other more or less marked peculiarities, but for the present we merely propose to give a general list of them, and to notice a few types that we have elsewhere included in this group, but which we are now rather inclined to think may yet be found to be entitled to more prominence than has generally been supposed. These are the forms for which the names *Alloprosallocrinus* (= *Conocrinus* of Troost's list) and *Eretmocrinus*, Lyon and Casseday, were proposed.

The first of these we only know from specimens consisting of the body without the arms or other parts. Its most striking peculiarity, so far as yet known, consists in its remarkable conical form, the body being nearly or quite flat below the arm-bases, which are at first directed out horizontally and then curve up; while the vault, which forms the whole visceral cavity, is produced upward in a conical form, so as to pass rather gradually into the central or sub-central tube, or so-called proboscis. This mere peculiarity of form, however, might be of little importance in a group presenting such great differences in this respect, but we observe that the arm-bases in the specimens of this type we have seen, are usually stouter and composed of rather wide short pieces, more like those composing the arm-bases of *Agaricocrinus*. From this fact we suspect that this type may present some marked differences in the nature of its arms from the typical *Batocrinus*.

The other group (*Eretmocrinus*) is mainly distinguished by a remarkable flattening of the upper part of the arms, by which they are made to present a very curious paddle-shaped or spatulate outline. In some instances this character is so strongly-marked, that the breadth of the arms is not less than six times as great above as below the middle. Below, the arms are, as in other types, usually rounded and slender, but farther up the flattening commences, first, by a slight angularity along each side, with often crenate margins, and increases upward above the middle until they sometimes present a very extraordinary alate appearance. The flattened part, however, is always as distinctly composed of a double series of alternately arranged pieces as that below, and these pieces are not only extended laterally to give breadth to the arms, but have also often as much as twice the diameter, in the direction of the length of the arms, of those further down. The ambulacral furrows, however, do not increase in size with the breadth of the arms, but even seem to be smaller above than below. We have not *seen* tentacula attached along the flattened upper part of the arms, but they probably existed there, as we have observed minute indentations at the inner ends of the flattened pieces, apparently for their attachment. The pieces composing the flattened part of the arms are thicker at their inner ends and thin off to their outer extremities, with slight outward curve, so as often to make the dorsal side of the arms not merely flat, but even slightly concave.

If these were free Crinoids, we might suppose this flattening of the arms a natural provision to adapt them for use as swimming organs, as *Comatula* is known to employ its arms for that purpose; but the species presenting this character have the column as well developed as we see in any of the other types, and were evidently attached to one spot during life. It is not improbable, however, that this peculiarity of the arms may have been a provision for the protection of the ova in the tentacula (pinnulæ), for, when these broad flattened arms were folded together, they must have covered these delicate parts within as if by a coat of mail.

The species presenting the character of arms described above, agree so closely in other respects with the typical forms of *Batocrinus*, that it is perhaps not always possible to distinguish them from specimens with the arms removed, though they seem generally to have a smaller number of arms, which are also generally longer in proportion, and a rather more excentrix ventral tube, or proboscis, which appears also to be more liable to be bent to one side, and is often more or less swollen in the middle and narrow below.

These two groups (*Alloprosallocrinus* and *Eretmocrinus*) should, we think, be at least separated subgenerically from the typical forms of *Batocrinus*, and may even be found to belong properly to distinct genera. We should certainly be disposed to view the *Eretmocrinus* group as a distinct genus, if it were not for the fact that the peculiarity observed in the structure of its arms is subject to considerable variation in the *degree* of its development in the different species, being not very strongly marked in some species, while we also observe some slight tendency to a similar flattening of the upper part of the arms in other types of the *Actinocrinidæ*, such, for instance, as in some species of *Dorycrinus*, and other forms usually referred, in this country, to *Actinocrinus*.

Below we add a list of the species of *Batocrinus*, which, it is worthy of note, are entirely confined to America, and, so far as yet known, nearly, if not entirely, to the lower Carboniferous rocks. We give first the names of the species of true *Batocrinus*, and under separate divisions those of *Eretmocrinus* and *Alloprosallocrinus*. We cannot, however, be *positively* sure, in all cases, in regard to the separation of the species of the subgenus *Eretmocrinus* from those of true *Batocrinus*, where specimens showing the arms are unknown. It will also be seen that, even as restricted by the separation, subgenerically, of *Eretmocrinus* and *Alloprosallocrinus*, the species referred to *Batocrinus* are susceptible of division into two sections, that may be entitled to greater prominence than is apparent from the specimens yet known.

1. Batocrinus, Casseday.

Section (a).—Species with arm-openings directed outward. Arms from 20 to 26. *Batocrinus icosidactylus* and *B. irregularis*, Casseday, and *B. formosus*, *B. discoideus*, *B. papillatus*, *B. æqualis*, *B. doris*, *B. lepidus*, *B. turbinatus*, *B. inornatus*, *B. longirostris*, *B. calyculus*, *B. biturbinatus*, *B. similis*, *B. lagunculus*, *B. mundulus*, *B. clavigerus* and *B. planodiscus*, Hall (sp.), all of which were described by Prof. Hall under the name *Actinocrinus*. Also *B. Andrewsianus* and *B. subæqualis*, described by Prof. McChesney under *Actinocrinus*. Likewise our *B. pistillus*, *B. pistilliformis* and *B. quasillus*. Also *B. rotundatus* (=*Actinocrinus*, O. and S.), as well as *B. Christyi** and *B. Konincki*,† described by Dr. Shumard under *Actinocrinus*.

Section (b).—Species with arm-openings directed upward, and arm bases usually more in groups than in Section (a). Arms, so far as known, 20.

B. Nashvillæ (=*Actinocr.*, Troost); also *B. laura* and *B. sinuosus* (=*Actinocrinus*, Hall), *B. æquibrachiatus* (=*Actinocrinus*, McChesney), and our *B. asteriscus* and *B. trochiscus*.

2. Subgenus Eretmocrinus, Lyon and Casseday.

Species with arms flattened and alate above, and generally numbering from 12 to 20. Proboscis or ventral tube excentric, usually slender below, and sometimes swollen in the middle, and more or less bent to one side. Vault usually depressed. Brachial pieces more or less in groups, separated by interradial and anal sinuses.

Batocrinus (*Eretmocrinus*) *magnificus*, Lyon and Casseday, and *B.* (*Eretmocr.*)

* This is the only species of the whole *Batocrinus* group known to have two arms springing from each arm-opening, and this does not arise from a proper bifurcation, as the two arms rest directly upon the brachial pieces, without imparting to them the character of axillary pieces.

† This species has its arms *slightly* flattened, but not expanded above, showing a gradation towards *Eretmocrinus*.

calyculoides, *B.* (*Eretmocr.*) *remibrachiatus*,* *B.* (*Eretmocr.*) *clio*, *B.* (*Eretmocr.*) *matuta* and *B.* (*Eretmocr.*) *clœlia*, Hall (sp.), all described under *Actinocrinus* by Prof. Hall. Also *B.* (*Eretmocr.*) *Vernueilianus*,† Shumard (sp.), described under *Actinocrinus*.

In all of the above species the arms have been seen, and are known to possess the characters of *Eretmocrinus*. The following species are believed to belong here from the general appearance of the body vault, proboscis, etc., though their arms have not yet been seen. They all certainly belong to *Batocrinus*, even if not to the group *Eretmocrinus*, viz.: *B. corbulus*, *B. carica*, *B. oblatus*, *B. sinuosus* and *B. gemmiformis*, all described by Prof. Hall under *Actinocrinus*. Also *B. urnæformis* and *B. Hageri*, described by Prof. McChesney under *Actinocrinus*. Also our *B. dodecadactylus*.

3. Subgenus Alloprosallocrinus, Casseday and Lyon (=*Conocrinus* of Troost's lists).

Body distinctly conical, being flat below the arm-bases (which are directed outward on a plane with the flattened under side), and produced upward to the central proboscis so as to bring the whole visceral cavity above the arm-bases. Branchial pieces stout.

B. (*Allopros.*) *conicus*, *B.* (*Allopros.*) *depressus*, Lyon and Casseday, described under *Alloprosallocrinus*. Also our *B.* (*Allopros.*) *euconus*.

New Species.

Batocrinus quasillus, M. and W.

Body rather depressed, wider than high, nearly as prominent above as below the arm-bases; sides spreading very rapidly from the top of the first radials to the brachial pieces, which are in close contact all around, so as entirely to isolate the anal and interradial pieces from the vault. Base comparatively rather broad, being nearly three times as wide as high, truncated and rather deeply excavated below, so as to overhang the end of the column; somewhat spreading below, with broad shallow notches at the sutures. First radials nearly twice as wide as high, two heptagonal and three hexagonal, and, like all of the other body plates (excepting the second radials), moderately tumid. Second radials generally very short, and sometimes, in part, merely transversely linear, or even entirely obsolete, all quadrangular, and flat on the outer side. Third radials small, generally pentagonal, and in all but the two posterior rays supporting on each of its superior sloping sides one, or sometimes two, secondary radials, the last of which (where there are more than one) is an axillary piece, and bears, in direct succession on each of its superior sloping sides, two brachial pieces, thus making four arms to each of these rays. In each of the posterior rays, however, there are two other bifurcations, that make six arm-openings to each of these rays, or twenty-four to the entire series. First anal plate of much the same size and form as the first radials, and supporting, in an arching series above, three smaller pieces in the second range, while above the latter, one, or perhaps sometimes two smaller pieces connect with the brachials above. First interradials about two-thirds as large as the first radials, and each supporting a smaller piece extending up to the brachials above. Vault composed of tumid, or sometimes rather obtusely pointed pieces, and provided with a subcentral proboscis, which is usually about as broad below as the base.

Height of the largest specimen to top of vault, about 0·70 inch; greatest breadth (which is at the arm-bases), 0·80 inch; breadth of base, 0·35 inch.

This species seems to be related to our *B. pistillus*, but may be easily dis-

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* Prof. Hall mentioned, in describing this species, that it has the characters of *Eretmocrinus*.

† This species has the arms less distinctly alate than the others, the transition from *Batocrinus* to *Eretmocrinus* being through this and the species *Konincki*.

tinguished by its much more depressed form, particularly below the arm-openings, caused by its much shorter basals, and first and second radial pieces. Its base also differs in being much more excavated, and not near so expanded below, while its brachial pieces are proportionally stouter, and more crowded. Although the whole number of arm-openings is the same in these two forms, this arrangement is different, the formula of *B. pistillus* being $\dfrac{\overline{5}\overset{4}{-}\overline{5}}{5-5} = 24$, and that of the form under consideration $\dfrac{\overline{4}\overset{4}{-}\overline{4}}{6-6} = 24$.

Locality and position.—Lower division of Burlington beds of Lower Carboniferous at Burlington, Iowa. No. 14 of Mr. Wachsmuth's collection.

Batocrinus Cassedayanus, M. and W.

Body rather broad subturbinate below, or with the vault subglobose, being a little larger below than above the arm-bases. Base short, or about four times as wide as high, a little thickened, and slightly overhanging the end of the column, and more or less notched at the sutures, so as to present a somewhat trilobate appearanee. First radial pieces of moderate size, and, like all of the other body plates, rather distinctly tumid, wider than long, two hexagonal and three heptagonal. Second radials about half as large as the first, nearly twice as wide as high, normally quadrangular, but some of them occasionally with one or both of the superior lateral angles a little truncated, so as to present an irregular pentagonal or hexagonal outline. Third radials sometimes a little smaller, and in other rays a little larger, than the second; all pentagonal, and (excepting in the anterior and one of the anterior lateral rays of the typical specimen) each supporting on each of its superior sloping sides, in direct succession, two secondary radials, generally of near its own size, the upper ones of which are also axillary pieces, and bear on each of their superior sloping sides two brachial pieces in direct succession (the last of which is generally larger than the first), thus making four arms to each of these rays. In the anterior ray, however, the third radial merely bears on each side above, three brachial pieces in direct succession, and the same is also the case on one side of one of the anterior lateral rays, thus only giving origin to two arm-openings in the first, and three in the latter, making seventeen arm-openings to the entire series. First anal of the same size and form as the first radials, excepting that it is proportionally a little longer; above this there are three smaller pieces in the second range, three in the third, and two or three in the fourth. First interradials of the same size as the second anals, hexagonal or heptagonal in form, and supporting two smaller pieces in the third range, with two to three or four still smaller pieces above, the upper one of which, like that of the anal series, separates the brachial pieces a little, so as to form a small sinus between the arm bases belonging to each ray.

Vault slightly ventricose, composed of very irregular, unequal, merely tumid pieces. and provided with a rather stout, nearly central proboscis, which is inclined a little forward in the typical specimen.

The specific name is given in honor of Mr. S. A. Casseday, deceased, the author of the genus *Batocrinus*.

Height of body to arm-bases, 0·70 inch; do. to base of proboscis, 1·07 inch; greatest breadth (at arm-bases), 1·20 inch.

This species is perhaps most nearly allied to *B. longirostris*, Hall (sp.), and if we suppose the presence of only three arm-openings in one of its anterior lateral rays to be abnormal, which is almost certainly the case, it would present no difference in its arm-formula, nor any marked difference in the details of its structure, excepting in the proportional sizes of certain plates. This latter character, however, imparts a material difference to the whole form of the body,—a difference, indeed, that is so striking as to be apparent at a glance. For instance, in *B. longirostris* the first and second primary radials and first anal, as well as the first interradial pieces, are all proportionally so much larger (particularly longer) as to make the body below the arms always distinctly longer and proportionally narrower. Another marked difference consists in the convexity of the body plates, those of *longirostris* being only slightly and evenly convex, while in the form under consideration they are decidedly tumid, and sometimes even angular. The arm-bases of the *longirostris* are also more distinctly separated by sinuses, and less robust. In short, the characters mentioned in the species *longirostris* impart to it a peculiar and very characteristic neatness and symmetry of appearance not seen in the form here described.

In form and general appearance our species resembles specimens sometimes supposed to be a broader and more robust variety of *B. subæqualis*, McChesney (sp.), but in that there are four arms to each ray, and the brachial pieces are in close contact all around, while its body plates are not merely tumid, but decidedly tuberculiform and projecting.

Locality and position.—Lower Burlington beds of the Lower Carboniferous, at Burlington, Iowa. No. 13 of Mr. Wachsmuth's collection.

Batocrinus trochiscus, M. and W.

Body broad discoidal or wheel-shaped, being very narrow at the base and widening gradually to the top of the first radials, thence spreading very rapidly to the brachial pieces, which are large and nearly in contact all around, or but slightly separated by small sinuses over the anal, interradial and axillary spaces. Vault flat, or a little concave from the periphery about half-way in toward the middle, thence rising moderately to the subcentral proboscis; composed of unequal pieces, the larger of which are rather tumid and arranged in radiating rows coincident with the rays and their division below, while the smaller pieces between are depressed so as to form concavities between the larger.

Base narrow, truncated, but not spreading or provided with a distinct rim below, wider than high, and widening very gradually upward. First radial pieces about of the size of the basal, but proportionally longer, though they are generally wider than long, two of them heptagonal and three hexagonal. Second radial pieces comparatively very small, and all wider than long, or transversely oblong, being, as usual in this group, regularly quadrangular. Third radial pieces about twice as large as the second, wider than long, and all pentagonal, excepting those of the two posterior rays, one of which is hexagonal and one heptagonal, in the specimen from which the description is drawn up; each supporting on each of its superior sloping sides, in direct succession, two secondary radials nearly or quite as large as the third primary radials themselves, while each of the upper of these secondary radials is an axillary piece, supporting on each of its sloping sides, in direct succession, two large brachial pieces, thus making four arm-openings to each ray all around, or twenty in the entire series. First anal piece about of the size of the smaller first radials, longer than wide, and heptagonal in form; above this there are in the second range three smaller hexagonal pieces, and, arching over the latter, four in the fourth range, with a small wedge-formed piece succeeding the latter above, though it is scarcely large enough to separate the brachial pieces over the anal area. First interradial pieces nearly as large as the first radials, and all irregularly nine-sided; above this there are two smaller pieces in the second range, two, or sometimes only one, in the third, and above this one or two succeeding each other in a direct line, the last one being usually narrow, and partly or entirely wedged in between the brachial pieces so as, in some cases, to separate them a little. Between the first divisions of each ray on the third radials there are usually one or two interaxillary pieces, the first resting upon two short sloping upper sides of the first secondary radials, and supporting the second, which sometimes separates the brachial pieces a little, while in other instances it is so narrow and short as to allow them to come in contact over it. (Arms and column unknown.)

The surface seems to be nearly smooth, or finely granular, and the body plates are nearly even, excepting the secondary radials, which, with the brachial pieces, are sometimes a little tumid, so as to project slightly beyond the plane of the interradial and interaxillary areas, which consequently have a somewhat sunken appearance.

Height of body to arm-openings, 1 inch; breadth, 2·10 inches.

This fine species seems to be most nearly related to *B. planodiscus*, Hall (sp.), from the Keokuk beds, with which it agrees nearly in form and general appearance. It differs very materially in structure, however, since the rays in that species bifurcate so as to make eight arm-openings to each ray, or forty to the whole series, being just double the number seen in our species. The *planodiscus* also appears to have the arm-openings directed outward, while the species under consideration belongs apparently to the section of this genus with these openings directed upward.

It is an interesting fact, to which our attention has been called by Mr. Wachsmuth, that not only this species, but several others only found in the very highest part of the Upper Burlington formation, are more nearly allied to species found in the Keokuk beds than to any forms in the Lower Burlington beds.

Locality and position.—Upper bed Burlington division of the Lower Carboniferous at Burlington, Iowa. No. 27 of Mr. Wachsmuth's collection.

BATOCRINUS (ERETMOCRINUS?) NEGLECTUS.

Body small, inversely campanulate below the arms, and rather ventricose above; the sides expanding gradually from the base to the third radials, and thence curving out rapidly to the outer edges of the brachial pieces, which are slightly grouped, but nearly or quite in contact all around. Base about three times as wide as high, truncated and concave below, but not thickened or expanded. First radials comparatively large, generally wider than long, and, as usual, two heptagonal and three hexagonal; all like the other body plates convex, but not properly tumid Second radials much smaller than the first, quadrangular and nearly twice as wide as long. Third radials as long as the second, or slightly larger, wider than long, and all normally pentagonal; each supporting on each of its superior sloping sides a secondary radial, which in its turn bears on each side above two brachial pieces in direct succession, thus making four arm-openings to each ray, or twenty to the entire series. In one specimen, however, agreeing exactly in other respects, the third radials in the anterior and one in the posterior rays is immediately succeeded by brachial pieces without any further bifurcations, so as to give origin to only two arms to each of these rays; but this is almost certainly an individual abnormal development.

First anal plate a little longer, but not otherwise differing from the first radials; above this there are three smaller pieces in the next range, and sometimes one or two still smaller ones in the third range. Interradial pieces one to three in each space, the first being one-third to one-half as large as the first radials, seven to nine sided, and usually supporting one or two smaller pieces in the second range above.

Vault convex, and composed of very unequal, irregular, moderately convex plates, provided with a tube or proboscis of moderate thickness, and placed generally about half way between the middle and the anal side. (Column and arms unknown.)

Height to base of proboscis, about 0·58 inch; do. to arm-openings, 0·33 inch; breadth, 0·55 inch. The specimen presenting the irregularity mentioned in the arrangement of the arms, is proportionally wider than that from which the above measurements were taken.

This little species is apparently nearer *B. clio*, Hall, (sp.), than to any other yet described. Its base, however, is much less thickened and expanded than in that species, and its body plates more even and smoother; while its brachial pieces are less prominent, so as to give its body a less spreading appearance. Judging from the description, the *B. laura*, Hall, (sp.), would seem to be somewhat like our species, but that form must be more depressed and proportionally wider, and is also said to have the arm-openings directed upward, which would even place it in a different section of the genus.

We place this species provisionally in the *Eretmocrinus* group, from its general appearance, as we have not seen any specimens showing the arms.

Locality and position. Lower division, Burlington group, of Lower Carboniferous, at Burlington, Iowa. No. 14 of Mr. Wachsmuth's collection.

Genus PENTREMITES, Say.

Pentremites (Troostocrinus?) Woodmani, M. and W.

Body attaining a large size, pyramidal-subovate, as seen in a side view, being broad below, and produced and gradually narrowing upward; strongly pentagonal as seen from above and below, in consequence of the projecting and actually carinated character of the radial pieces. Base strong, from two and a half to three times as wide as high, trilobate in general outline below, and very broadly and profoundly excavated along the three sutures, (the excavations being continued out beyond the base into the lower ends of three of the radial pieces); two of them pentagonal and tricarinate, and one quadrangular and bicarinate, the carinæ projecting considerably below the deeply sunken facet for the attachment of the column, so that when placed erect on a level surface the body stands upon these carinæ, like a tripod upon its legs. Radial pieces long and narrow, or about three times as long as wide, and gradually tapering upward; all extremely prominent along the middle and sloping strongly inwards laterally, very sharply carinate below the pseudo-ambulacral areas. Summit openings very small and closely approximated. Interradials very small, or only about one-tenth as long as the radials. Pseudo-ambulacral areas remarkably narrow or sublinear, and deeply sunken, extending down rather more than half the entire length of the body, or about two-thirds the length of the radial pieces; pore pieces minute, slightly oblique, and numbering about 100 to each side of each area, the two rows of each area being separated by a deep mesial furrow, along which the inner ends of the pore pieces are minutely crenate, lanceolate and supplementary pore-pieces unknown. Surface marked with microscopic lines, as fine, regular, and crowded, as if made by an engraver's ruling machine.

Height, 2·25 inches; breadth, 1·64 inches. Breadth of base, 1·14 inches; height of do., 0·50 inch; depth of excavations along the sutures of base, 0·20 inch; breadth of do. from 0·45 to 0·56 inch. Length of pseudo-ambulacral areas, 1·45 inch; breadth of do., 0·08 inch.

This extraordinary form differs so widely from all other known species, as to render a comparison of its specific characters with any of those hitherto described entirely unnecessary. It seems to be related to a group of species characterized by a triangular base, and very narrow pseudo-ambulacral areas, for which Dr. Shumard has proposed the name *Troostocrinus*. Still it presents some rather strongly marked differences from that group, the species of which have the body narrow, fusiform, and more or less elongate and tapering below, with the triangular base merely flattened on each of the three sides. In our type however, the body is broadest below, while the base is comparatively very short and wide, and has the three spaces corresponding to the flattened sides of the typical species of *Troostocrinus* so very profoundly and broadly excavated, as to impart a very remarkable appearance to the lower part of the fossil. Should it be thought desirable to designate this type by a distinct subgeneric name, it might be called *Tricœlocrinus*, in allusion to the three deep excavations of the base.

The specific name of this form is given in honor of Mr. H. T. Woodman, of Dubuque, Iowa, to whom we are indebted for the use of the only specimen we have seen.

Locality and position.—Salem, Indiana. Lower Carboniferous, Keokuk Group?

Genus AGELACRINITES, Vanuxem.

AGELACRINITES (LEPIDODISCUS) SQUAMOSUS, M. and W.

Depressed discoidal; outline circular, or somewhat oval. Rays slender, long, and strongly curved as they radiate from the middle toward the periphery, around which they are each extended for some little distance; all sinistral excepting the right posterior one, which curves to the left, with its outer half extending around within that of the next one on the left, near which it terminates at the so-called ovarian protubrance; each composed of two zigzag rows of very small pieces, with some irregular ones apparently not belonging properly to either row. Disc composed of large, thin, irregular, strongly squamose or imbricating plates, the imbrication being inward from the periphery, that is, the inner edge of each plate laps upon the outer edge of the next within. Ovarian? pyramid situated near the left outer margin of the posterior interbrachial space, and closed by ten pieces, apparently imbricating laterally and forming a depressed cone, around the base of which there are numerous small, short, but comparatively wide imbricating disc plates. Surface minutely granular.

Greater diameter of an apparently distorted specimen, 1·70 inch.

The only specimen of this species we have seen is somewhat crushed and distorted, so that it is rather difficult to make out the exact details of the structure of the rays, though they are apparently not provided with *open* ambulacral furrows, the rows of minute plates on each side, apparently closing up and interlocking. There appear, however, to be pores arranged along them in a zigzag row between the pieces. The body plates around the margin are much wider than high, and strongly imbricating upward. No central opening is visible.

On comparing this species with *A. Kaskaskiensis*, Hall (the only other known Carboniferous species), the type of which is now before us, we find that our species differs in the important character of having its disc plates all very distinctly imbricating, while those of Prof. Hall's species show no tendency to imbricate, the whole surface of each being clearly exposed, their straight edges being merely joined together like those of a true crinoid. From Prof. Hall's description, it might also be supposed that this species differs in the number of its rays, as he described it as having six rays. A careful examination, however, of the typical specimen has clearly satisfied us that this is certainly not the case, as it has only five, the usual number, as represented in the figure. It is the incurved extremity of the dextral right posterior ray, that has been mistaken for a sixth ray. The specimen is somewhat crushed and distorted, but by carefully cleaning it and removing some adhering portions of the matrix, this ray can be traced straight out to the periphery, where it curves abruptly around and extends inward to near the middle of the posterior interbrachial space, where it terminates at a point near which was doubtless situated the so-called ovarian pyramid; though the specimen is too much crushed there to show the latter.

It is worthy of note that our species, although agreeing with most of these that have been referred to *Agelacrinites*,* in the imbricating character of its disc plates, as well as in the direction of the curvature of its rays, still differs from *A. Hamiltonensis*, of Vanuxen, the type of the genus in both of these characters. Vanuxem gives no description, but judging from his figure, (Geol. Report Third Dist. N. Y., p. 306) one would naturally sup-

* By some oversight, Prof. Pictet figures, on pl. xcix, fig. 25, of his valuable Trait de Palæont., a true *Agelacrinites*, and probably one of the Cincinnati species, under the name *Hemicystites parasitica*, Hall, a very different fossil from the Niagara group. He also alludes to Vanuxem's *Agelacrinites Hamiltonensis* in the text as a Silurian species, but it is a Hamilton group (Devonian) fossil. Dujardin and Hupé (Hist. Nat. Echinod. pl. 5, fig. 8) copy Pictet's figure under the name *Agelacrinites parasitica*, as an illustration of *Agelacrinites*, saying *Hemicystites* ought not to be separated from *Agelacrinites*. The real *Hemicystites parasitica*, however, although related to *Agelacrinites*, differs in several important characters.

pose the disc plates of his species to have the usual imbricating arrangement. Prof. Hall, however, has recently described it in detail, (Twentieth Report Regents Univ. N. Y. on State Cab. Nat. Hist. p. 299, 1868), and distinctly states that its interbrachial or disc plates are not imbricating, as in other species. He also mentions the fact that this typical species differs from others in having its anterior and right anterior and posterior lateral rays sinstral, and its left anterior and posterior-lateral rays curved to the left, as shown in Vanuxem's figure. It therefore certainly seems to us doubtful whether species differing in two such important characters as these are strictly congeneric. If they are not, then a new generic name should be applied to our species, and the others agreeing with it in these characters; in which case we would propose to designate this group of species under the name *Lepidodiscus* (λεπίς, a scale, and δίσκος, a quoit). At least we should think they ought to be separated subgenerically.

Locality and position. Crawfordsville, Indiana. Keokuk beds of Lower Carboniferous.

ECHINOIDEA.

Genus OLIGOPORUS, Meek and Worthen.

Oligoporus nobilis, M. and W.

Large, globose, composed of very thick plates. Ambulacra nearly flat, or slightly convex, and without proper furrows, narrow lanceolate in outline, or only about two-thirds as wide as the interambulacral areas; pore pieces comparatively small, wider than high, those of the two outer rows rather more irregular in size, and some of them a little larger than any of those of the two inner rows; pores two to each piece, forming four double rows, those of the two outer ranges of pieces being placed near their inner ends, and those of the inner ranges near their outer ends. Interambulacral areas comparatively large, moderately convex, and composed of five rows of large plates, all of which extend to the disc above, while the middle one ends within about 0·65 inch of the oral opening below. Vent and apical disc much as in *Melonites multipora* Surface of all the plates, both ambulacral and interambulacral, ornamented with coarse granules, separated by spaces generally a little wider than their own breadth, with sometimes a few smaller ones between. Of these granules, about 40 to 60 may be counted on each of the larger interambulacral plates.

Height and breadth, about 3·75 inch; breadth of ambulacral spaces, 0·60 inch; do. of interambulacral areas, 1·06 inch. Height of largest interambulacral plates, 0·26 inch; breadth of do., 0·40 inch; thickness of do., 0·25 inch.

The only specimen of this fine species yet known to us is mainly a silicious cast of the interior. The connection of the plates, however, are so distinctly defined by sharply raised lines formed by the silicious matter deposited in the sutures between all of the pieces before they were dissolved, that the entire structure can be made out as well as if the plates themselves had been preserved. A few of the plates, however, or rather casts of their external surface, remain so as to show the surface granules as well as the thickness of the plates themselves.

The apical disc seems to be very similar, as already stated, to that of *Melonites multipora*,—the arrangement and comparative sizes, as well as form of the ocular and genital plates, being much the same. In two of the latter, five pores may be counted in each, while one other also shows obscure indications of five pores and the other two had four each, as near as can be made out from the little projecting points representing them in the cast. No satisfactory indications of pores, however, are to be seen in the ocular pieces.

Although the ambulacral areas are not properly furrowed, as in *O. Danæ* and *Melonites multipora*, they are slightly depressed below the most convex central region of the interambulacral areas. The depression, however, also includes the two marginal rows of each interambulacral series. There is likewise a faint narrow, almost linear, impression on the internal cast, extending from the apical disc about half way down the middle row of plates in each interambulacral field.

This form can be at once distinguished from *O. Danæ*, the only other known species of this type, by its proportionally much larger and less numerous interambulacral plates, of which there are only *five* instead of *eight or nine* rows to each area. Its ambulacral areas are also proportionally narrower, and, as already stated, differ in not being furrowed along each side, with a ridge along the middle.

As we have elsewhere suggested, the group *Oligoporus* seems to be exactly intermediate in its characters between *Melonites*, Owen and Norwood, and *Palæchinus*, (Scouler) McCoy. That is, it differs from *Palæchinus* in having *four* rows of ambulacral pieces and four double rows of pores, instead of *two* of each, as well as in having the ambulacral areas more or less sunken below the interambulacral fields. In the last character it agrees more nearly with *Melonites*, from which, however, it differs widely in having only *four* rows of ambulacral pieces and *four* double rows of pores instead of *ten* of each to each area. In the nature of its apical disc the species under consideration shows that in this type it agrees well in its general characters with *Melonites*. We also know, from a crushed specimen of *Oligoporus Danæ*, that the species of this group have the jaws very like those of *Melonites*. The question may therefore arise whether or not these differences in the *number* of pieces and pores of the ambulacra are of generic importance, and whether we ought not to regard them as only subgeneric and call our species *Melonites* (*Oligoporus*) *nobilis*. On the same grounds, however, we would have as good reason to regard both *Oligoporus* and *Melonites* as mere sections or subgenera of *Palæchinus*. We cannot, however, believe so important and constant a difference of less than generic value, no gradations being yet known in this character between *Oligoporus* and *Melonites* on the one hand, or between the former and *Palæchinus* on the other. It is true we yet only know one species of *Melonites*, but we now know two well marked species of *Oligoporus*, while there are eight or nine known distinct species of *Palæchinus*, all of which latter agree in having but two rows of ambulacral pieces to each area.

At the time we proposed the name *Oligoporus* we were not aware that Prof. Desor had designated a section (not a genus) of the family *Cidaridæ* by the name *Oligopores*. In case this should be regarded as a serious objection to our name *Oligoporus* we suggested, in the second volume of the Illinois Geological Reports, the name *Melonopsis* tor this group instead: and if it should be adopted, the species here described would have to be called *Melonopsis nobilis*. The name *Oligopores*, however, from its different termination, we should think sufficiently distinct.

Locality and position.—Calhoun County, Illinois, from the Burlington division of the Lower Carboniferous series.

Description of Seven New Species of AMERICAN BIRDS from various localities, with a note on Zonotrichia melanotis.

BY GEO. N. LAWRENCE.

1. Dendrœca capitalis.

Male. Front and crown of a deep rich reddish brown; back and smaller wing coverts yellowish olive-green, becoming more yellow on the rump; central tail feathers and the outer webs of the others dark olive-brown, edged the color of the back, the inner webs of all except the central tail feathers are yellow; the quill feathers and the larger wing coverts are blackish brown, the primaries and secondaries with margins the color of the back, the tertiaries and wing coverts edged with yellow; under lining of wings deep yellow; under plumage deep golden yellow, with conspicuous reddish brown stripes on the breast and sides; bill blackish brown, the under mandible paler below; feet light brown.

Second, third and fourth quills equal and longest, first intermediate between fourth and fifth.

Length $4\frac{1}{2}$ in.; wing $2\frac{1}{4}$.; tail 2 1-16th; bill 7-16ths; tarsi $\frac{3}{4}$.

The female differs in wanting the brown cap, having in place of it a slight wash of that color, and in there being only a few faint stripes on the breast.

Habitat.—Barbadoes. Types in my collection, obtained by Mr. A. H Alexander, of West Hoboken, N. J., who informed me that it is an abundant species and familiar in its habits.

Remarks. This beautiful species needs comparison only with *D. petechia*, and the bird from St. Thomas and St. Croix, referred to *D. ruficapilla*, Gm., by Prof. Baird, with a ?, see Rev. Am. Birds, pp. 199 and 201; it is smaller than either, and they do not agree in the wing formula; the present species appears to have a greater extent of yellow in the tail feathers.

It is the same species as a specimen spoken of by Prof. Baird (Rev. Am. Birds, p. 202) but not named, which was brought from Barbadoes in alcohol by Prof. Gill.

Apart from its smaller size, its clearly defined and deeply colored crown will distinguish it from all others.

2. Tachyphonus atricapillus.

Front, entire crown and occiput black, sides of the head and the hind neck grayish-black; back and smaller wing coverts dark olive-green, the rump olive, tinged with ferruginous; tail brownish-black bordered with greenish-olive; middle and larger wing coverts black, with greenish olive margins; quills black, the primaries narrowly edged on the outer webs with greenish yellow, the secondaries with olive green; under wing coverts pale yellow; throat of a light brown intermixed with gray, and tinged with rufous; lower part of the neck and sides of the breast olive-green washed with ferruginous; breast and abdomen bright brownish ferruginous, becoming yellowish on the middle of the belly; under tail coverts black bordered with ferruginous; bill black, the under mandible whitish at base; tarsi and toes black.

Length (skin) 5 in.; wing $2\frac{1}{2}$; tail $2\frac{1}{4}$; bill $\frac{1}{2}$; tarsi $\frac{5}{8}$.

Habitat.—The Island of Trinidad.

Type in my collection; it was killed at Trinidad in the early part of the present year by Mr. A. H. Alexander, from whom I procured it. A person who accompanied him at the time, and was familiar with the birds of the Island, said it was a species he had never noticed before.

Remarks.—This does not resemble in plumage any other member of the genus, and I think is probably a male; the black crown and distinctly colored under plumage seem to preclude the probability of its being a female.

3. Quiscalus fortirostris.

Male. Black, with purplish steel blue lustre, uniform throughout the body, not changeable as in most other species; wings and tail greenish, bill and feet black.

Second quill longest, first between third and fourth; tail graduated, lateral feather one inch shorter than middle feathers; bill very strong, culmen regularly curved throughout, commissure sinuated.

Length 9 in.; wing $4\frac{1}{4}$; tail $4\frac{1}{8}$; bill from front 1 1-16th; height of bill at base 7-16ths; tarsi 1 3-16ths.

The female is smaller, and the plumage, instead of being bluish, has a brownish cast of color.

Length 8 in.; wing $3\frac{5}{8}$; tail $3\frac{1}{4}$; bill 15-16ths; tarsi 1 1-16ths.

Habitat.—Barbadoes. Types in my collection, obtained from Mr. A. H. Alexander, by whom they were killed on that Island.

Remarks.—This very distinct species comes nearest to *Q. lugubris*, Sw., in its dimensions, but is rather smaller; that species is more violaceous in lustre, with longer and stouter legs, also a longer, straighter and more feeble bill, with the commissure straight; the bill of the new species is comparatively large, at the base being wider and fully one-third higher than that of *Q. lugubris.*

4. Thamnophilus virgatus.

Entire head, hind neck and all of the under plumage, of a grayish fuliginous color, blacker on the head and grayer below, with a broad stripe of pale ochreous white down the centre of each feather; these are clearer or nearly white on the head, and duller on the abdomen; back, tail and exposed portion of the wings cinnamon red; the inner webs of the quill feathers liver brown; the under wing coverts and inner margins of quills pale cinnamon: under tail coverts pale rufous; upper mandible black, the under whitish horn color; tarsi and toes black, claws whitish.

Length about 6 in.; wing 3; tail $2\frac{5}{8}$; bill about $\frac{5}{8}$; tarsi 1.

Habitat.—New Granada, Turbo. Collected by Lt. Michler. Type in Mus. Acad. of Nat. Sciences, Philadelphia.

Remarks.—In distribution of colors this species much resembles *T. palliatus*, but it is smaller and differs notably in the white markings throughout, being longitudinal; the crown in *palliatus* is immaculate, on which in the present species the stripes are strongly defined; the red coloring is paler and duller than that of *T. palliatus.*

From analogy I judge it to be a male, as the female of *T. palliatus* has a rufous crown.

The bill is injured by shot, the end being deficient; at first I was puzzled to know where to place it, but feel confident it is assigned its true position.

Analytical table of the Species of BARIDIUS inhabiting the United States.

BY JOHN L. LE CONTE, M.D.

According to the form of the antennæ the species before me may be divided into three principal groups, of which the second contains all the strongly pubescent species. The first group is the most numerous, and may again be subdivided by the presence or absence of the apical constriction of the prothorax. We will thus have the following scheme of arrangement.

A. Antennæ thick; 2d and 3d joints of funiculus equal.
  a. Body nearly glabrous. Thorax not constricted near the apex. Sp. 1—8.
  b. Body nearly glabrous. Thorax constricted near the apex. Sp. 9—22.
  c. Body densely pubescent; thorax constricted near the apex. Sp. 23—25.
B. Antennæ slender; 2d point of funiculus longer than the 3d. Sp 26—28.

A—a.

Intervals of elytra coarsely and irregularly punctured. 1.
" " with single rows of usually well marked punctures. 3.
" " with very fine inconspicuous punctures. 4.

1. Color black. 2.

Color bronze-black; prothorax longer than wide, gradually narrowed from base, rounded near the apex; dorsal carina very indistinct; beak stout, curved, moderately long, punctured. Long. 4·5 mm. Middle States. 1. subæneus.

2. More shining; prothorax not longer than wide, very slightly narrowed from base, much rounded near the apex; dorsal carina not apparent; beak stout, short, curved, punctured. Long 4·5 mm. Kansas (one specimen).
2. quadratus.

Similar to the last in size, form and sculpture, but the dorsal carina of the prothorax is well marked. Long 4·5 mm. Texas, Illinois. (Two specimens) .... 3. carinulatus *Lec.*

Less shining; punctures of elytra smaller and closer; prothorax more equally rounded on the sides, not broader than long, without dorsal carina; beak moderately long, stout, curved, punctured. Long. 4·5 mm. Kansas. (2 specimens).. 4. transversus *Say.*

3. Black bronzed, shining; prothorax not longer than wide, very slightly narrowed from the base, much rounded near the tip, dorsal carina not obvious. (Resembles B. subæneus, but differs by the more full thorax, rather stouter form, and less irregular interstitial punctures of the elytra.) Long. 4—4·5 mm. Middle and Southern States...................... 5. tumescens.

Smaller, black bronzed, shining; prothorax not longer than wide, more obliquely narrowed at tip and less rounded, dorsal carina not obvious; elytral striæ less strongly punctured than in B. tumescens; intervals with rows of well marked or very fine punctures. Long. 3 mm............ 6. confinis.

Black bronzed, very shining, prothorax more sparsely punctured, slightly narrowed from the base, broadly and obliquely rounded near the tip; elytra more finely and less deeply striate, intervals wider, nearly smooth. Long. 2·5—3 mm. Louisiana.. 6. aereus *Sch.*

4. Bluish black, shining; prothorax not longer than wide, obliquely narrowed from the base, broadly rounded near the tip, punctures more distant than usual, dorsal carina not obvious; elytral striæ scarcely perceptibly punctured, interstices nearly smooth, or with rows of very small punctures. Long. 4·25–4·75 mm. Middle and Southern States; five specimens. (Differs from *B. aereus* in color and in form of prothorax.) ..... 7. interstitialis *Say.*

Black, shining; body narrow, prothorax longer than wide, sides broadly rounded in front, disc strongly punctured, without dorsal carina; elytra with a feeble oblique impression near the base, striæ scarcely punctured; interstices with rows of very fine punctures. Long. 3·5 mm. California; two specimens; San Francisco.. 8. macer *Lec.*

A—b.

(The beak is longer and more slender than in A—a, and the thorax is transversely impressed near the tip, at least on the sides.)

Prothorax at base nearly as wide as the elytra. 1.

Prothorax at base narrower than the elytra; black, shining, very coarsely sculptured, elytral intervals not wider than the striæ, and marked with single rows of deep punctures. Long. 5·5–6·5 mm. Illinois, Kansas, Arizona. 9. striatus *Say.*

1. Body nearly glabrous, color black, 2.

" " color bright brown, 8.

Body rather robust and convex, brownish black, more pubescent than usual; prothorax wider than long, gradually narrowed from the base and feebly rounded on the sides; elytral intervals with rather confused rows of somewhat transverse punctures. Long. 4—5 mm. Kansas. (Resembles in appearance a *Centrinus*). .... 10. farctus.

Body robust, black, more pubescent than usual, prothorax wider than long, feebly narrowed from the base, sides much rounded in front almost straight behind, very densely and coarsely punctured, with a slender carina; elytral intervals wider than the striæ, densely and confusedly punctured. Long. 4 mm. California, 3 specimens. S. Diego..................... 11. densus *Lec.*

2. Prothorax with distinct smooth dorsal line. 3.

" without " " " 6.

3. Elytral intervals usually not wider than the striæ, with rows of very strongly marked punctures; body larger and wider. 4.

Elytral intervals wider than the striæ, with single rows of finer shallow punctures; body smaller and narrower. 5.

4. Prothorax gradually narrowed from the base, broadly rounded on the sides, more strongly towards the tip, coarsely punctured, the punctures more distant than the length of their diameters; (elytral intervals and striæ as in B. striatus; resembles B. carinulatus, but the prothorax is distinctly impressed on the sides near the tips,) Long. 6 mm. Kansas and Wisconsin.. 12. strenuus.

Resembles the preceding in form and sculpture, but the punctures of the prothorax are larger and more distinctly umbilicated, and the sides more deeply constricted near the tip. Long. 5 mm. Penna., one specimen; Mr. Rathvon.. 13. umbilicatus.

Somewhat narrower and more regularly oval, prothorax gradually but more strongly narrowed from the base, and more obliquely rounded near the tip, less coarsely but somewhat more densely punctured than in B. strenuus; elytra with the intervals wider than the striæ, with rather confused rows of fine but well marked punctures. Long. 6 mm. Wisconsin, 1 specimen.
14. subovalis.

5. Punctures of prothorax more distant than their diameter, sides scarcely narrowed from the base, more broadly rounded near the tip, dorsal line wide; elytral intervals wider than the striæ with rows of distant large shallow punctures. Body less convex than usual. Long. 3·5 mm. New Mexico, 1 specimen.. 15. distans.

Prothorax more densely punctured, sides slightly narrowed from the base, more obliquely rounded near the tip and more distinctly constricted; elytra as in the preceding, but with a small white pubescent basal spot each side, and a few scattered white scale-like hairs. Long. 3—4 mm. Southern States, 3 specimens..... .... 16. nigrinus *Say*.

6. Body oval or elongate. 7.

Body broadly ovate, black shining, prothorax wider than long, strongly but not densely punctured, with very feeble dorsal carina, sides narrowed from the base, strongly rounded in front, and deeply constricted near the tip; elytral intervals wider than the striæ, with rows of small but deep punctures. Long. 2·5—3 mm. Middle States, 4 specimens..................... 17. ovatus.

7. Body oval, black shining, prothorax not wider than long, strongly and densely punctured, without dorsal carina, sides narrowed and broadly rounded from the base, slightly constricted near the tip; elytral intervals broad, with rows of very fine but well marked punctures. Long. 2·5 mm. Middle States, 2 specimens.. 18. pusillus.

Body elongate oval, black, less shining, prothorax longer than wide, more coarsely punctured, punctures less distant than the length of their diameters, without dorsal carina, sides converging from the base, rounded only near the apex, which is feebly constricted; elytral intervals a little wider than the striæ, with rows of well marked punctures, disc feebly impressed obliquely each side behind the shoulder. (Of the same form as B. macer, but otherwise quite distinct. It differs remarkably from all the others of this division by the 2d joint of the funiculus of the antennæ being somewhat longer than the 3d, though much less conspicuously than in the species of division B.) Long. 3—3·5. Illinois and Kansas, 5 specimens... .... 19. angustus.

Also slender in form, black, not very shining, prothorax punctured as in the preceding, with the sides not converging from the base, but parallel, and more strongly rounded in front, tip feebly constricted; elytral intervals wider than the striæ, with rows of well marked punctures. (Resembles B. macer, but the thorax is more full in form, more densely punctured, and is feebly constricted at the tip; the beak is also longer and more slender.) Long. 2·5 mm. California, 1 specimen. San Francisco............. .... 20. seriatus *Lec*.

Somewhat less slender, bronzed black, shining, prothorax scarcely larger than wide, narrowed from the base and feebly rounded on the sides except near the tip, where it is more strongly rounded and slightly constricted disc, coarsely but more sparsely punctured than usual, punctures more distant than the length of their diameters; elytral striæ impunctured, intervals much wider than the striæ, with single rows of small punctures. Long. 3 mm. One specimen, Oregon.......................... .... 21. sparsus.

8. Body elongate, bright brown, very shining, prothorax rather sparsely punctured with a broad undefined smooth medial line; elytral uneven, with a transverse impression before the middle, an oblique one behind the humeri, and a very faint one behind the middle; striæ feebly punctured, intervals much wider than the striæ, with scarcely perceptible rows of very fine punctures. Long. 3 mm. Ohio and Illinois; (depredates on grape vine, producing the gall described by Mr. Walsh as *vitiscunnus*.).... 22. Sesostris.*

A—c.

The species contained in this group are of a slender form like some of those in b, and like them have an elongated moderately slender beak; the antennæ are not quite so stout, though the 2d joint of the funiculus is not conspicuously longer than the 3d. The body beneath is densely clothed with depressed ash colored hairs, and is equally densely pubescent above. The prothorax is constricted near the tip, and the disc is strongly and densely punctured with a slightly elevated dorsal line. The species of this group have the last tarsal joint more elongated than in the other species of the genus, and the claws closely approximated, and somewhat connate at base; the males are also distinguished by the last ventral segment being armed at tip with a small tooth. These differences, combined with those of appearance, produced by the dense covering of hair, would indicate the propriety of separating them as a distinct genus.

Prothorax feebly constricted near the tip. 1.
" more strongly " " " 2.

1. Small, pubescence less dense, prothorax longer than wide, feebly narrowed in front, slightly rounded on the sides, and feebly constricted near the tip, without basal glabrous spots. Long. 3 mm. Maryland, 1 spec..23. plumbeus.

Larger, pubescence very dense, prothorax very little longer than wide, gradually narrowed in front, slightly narrowed on the sides, and feebly constricted near the tip, with three basal glabrous black spots extending upon the scutellum and base of elytra. Long. 4·5 mm. Atlantic States, abundant.......... .... 24. trinotatus *Say*.

2. Larger, pubescence dense, prothorax scarcely longer than wide, subtrapezoidal gradually narrowed from the base, sides nearly straight, suddenly rounded near the tip and more strongly constricted, coarsely and densely punctured, distinctly carinated, marked with basal spots as in the preceding. Long. 4·5—6 mm. California, also at Cape San Lucas, 3 spec.
25. mucoreus *Lec*.

B.

The species of this division have the beak longer and more slender than those of A, and the antennæ are much thinner, the 2d joint of the funiculus is much longer than the 3d, thus showing an approach to Centrinus, which these species resemble in their form; the body is nearly glabrous, and the prothorax is constricted near the tip.

The three species before me may be distinguished as follows:

Body black, somewhat shining, prothorax strongly punctured, without dorsal carina, gradually and strongly narrowed from the base, and rounded on the sides; elytral intervals with single rows of strongly marked punctures, humeri scarcely wider than the base of prothorax. Long. 3·5 mm. Kansas, one specimen. .... 26. nasutus.

* Vide Herodotus, Euterpe, cap. 102.

Body black, shining, prothorax as in the preceding, elytra at humeri distinctly wider than base of prothorax, intervals with confused fine punctures. Long. 3·5—4·5 mm. Southern States, 4 specimens. (Rather stouter in form than the preceding, and resembling almost exactly B. farcus, but quite different by the antennæ and beak.)...... .... 27. ibis.

Body brown, shining, prothorax longer than in the preceding and less rounded on the sides, more densely punctured with a faint dorsal carina; elytra at humeri distinctly wider than base of prothorax, intervals wtth confused fine punctures. Long. 3·5 mm. Georgia and Illinois, 4 specimens.
28. scolopax *Say.*

Bibliography.

B. carinulatus *Lec.* Proc. Ac. Nat. Sc., Phila., 1858, 79.

B. transversus *Say.* Curc. 18; ed. Lec. i, 282.

B aereus *Sch.* Curc. viii, 141.

B. interstitialis *Say.* Curc. 18 and 26; ed. Lec. i, 282, 295; Journ. Acad. N. S. Ph. iii, 314; ed. Lec. ii, 176; *Sch.* iii, 684; viii, 149. In well preserved specimens small scale-like hairs are perceived in the rows of punctures on the elytral intervals.

B. macer *Lec.* Rep. Pac. R. R. Expl. xi, MS. 58.

B. striatus *Say.* Curc. 17; ed. Lec. i, 281.

B. densus *Lec.* Proc. Ac. Nat. Sc., Phila., 1859, 79.

B. nigrinus *Say.* Curc. 31; ed. Lec. i, 295. Sch. Curc. iii, 691; viii, 154.

B. seriatus *Lec.* Rep. Pac. R. R. Expl. xi, MS., 58.

B. trinotatus *Say.* Curc. 7; ed. Lec. i, 280; *vestitus*‡ Sch. Curc. iii, 718.

B. mucoreus *Lec.* Proc. Ac. Nat. Sc., Phila., 1858, 79.

B. scolopax *Say.* Curc. 26; ed. Lec. i, 295; Sch. Curc. iii. 699. I do not know for what reason Schönherr has referred this species to his first division; Boheman, in the description, mentions the antennæ as *minus crassæ*, which in fact they are.

Species unknown to me.

B. T-signum *Sch.* Curc. viii, 154.

B. anthracinus *Sch.* Ibid, iii, 727. Seems to be near 28. ibis *Lec.*

B. confertus *Sch.* Curc. iii, 728.

B. californicus *Motsch.* Bull. Mosc. 1845, ii, 372.

B. pubescens *Uhler*, Proc. Ac. Nat. Sc., Phila., 7, 417 belongs to *Centrinus* and is C. pistor Sch. = *Balaninus pistor* Germ.

The GYRINIDÆ of America, north of Mexico.

BY JOHN L. LE CONTE.

Species of this family are found in every part of the United States and contiguous northern regions, usually in large colonies; from their whirling motion of the surface of the water they are popularly known as *whirligigs*, and, on account of the agreeable fragrant odor of some of the species, as *apple-bugs*.

There is a remarkable uniformity of appearance in the species of each genus, which renders their definition and recognition somewhat difficult; for this reason, notwithstanding the very curious structural characters displayed in their organization, which are detailed in all systematic works, they are not favorites with collectors, and many of our species have remained unnamed.

Three genera are represented in our fauna:

Last ventral segment depressed, rounded at tip:

Scutellum distinct: labrum transverse............ .... Gyrinus.

Scutellum invisible; labrum transverse...................... .... Dineutus.

Last ventral segment elongated, conical:

Scutellum invisible; labrum prominent.... .... Gyretes.

DINEUTUS McLeay.

CYCLINUS Kirby.

The species of this genus are of larger size than those of the other two, and of less convex form; the elytra are marked with nine very slightly impressed, sometimes almost invisible, striæ or furrows; the labrum is rounded in front and ciliated, the scutellum is invisible, and the mesosternum is sparsely but coarsely punctured in front.

In the males the front tarsi are moderately dilated, and clothed beneath with feathery papillæ densely arranged in transverse lines, forming an elongated narrow brush; in *D. sublineatus*, *emarginatus*, *serrulatus*, and probably in *carolinus*, the front thighs of the male are dilated near the knee, on the anterior margin, into a more or less developed tooth, varying somewhat in form, according to the individual degree of development, but always well marked; in *D. vittatus*, *discolor* and *assimilis*, the tooth is entirely wanting.

The hind margin of the elytra is not toothed, nor strongly serrate, in any of our species, which may be divided into two groups as follows:

A. Sutural angles of elytra rounded.
B. Sutural angles of elytra well defined, sometimes slightly prolonged.

A.

14·5—15·5 mm. Black or black-bronzed, very shining; elytra usually with a brighter bronzed vitta; striæ faint; sutural angle very much rounded; under surface dark chestnut-brown, middle and hind legs pale......... 1. vittatus.

15·5—16·5 mm. Dark olive above, not very shining; elytral striæ distinct; sutural angle moderately rounded; under surface black; middle and hind legs iridescent, with the tibiæ and tarsi brown..................... 2. sublineatus.

9—12·5 mm. Black, or black-bronzed, not very shining; elytral striæ very faint; sutural angle very much rounded, apical margin flat; under surface dark brown or blackish, slightly bronzed; middle and hind legs, narrow margin and tip of abdomen paler, nearly testaceous........... 3. emarginatus.

10·5 mm. Black-bronzed, more shining; elytral striæ very faint; sutural angle less strongly rounded; apical margin narrowly reflexed; under surface brown; middle and hind legs, broad margin and tip of abdomen pale. 4. carolinus n. sp.

B.

a. Body brown or testaceous beneath, oval, narrowed in front; hind margins of elytra very feebly sinuate; sutural angle of ♂ not, of ♀ very feebly prolonged.

12·5 mm. Body broadly oval, narrowed in front; upper surface black, slightly bronzed, shining; lateral margin of elytra broadly flattened; apical edge very finely serrate....................................... 5. serrulatus n. sp.

11—12·5 mm. More convex and narrower, narrowed in front; upper surface black-bronzed, rarely black, shining; lateral margin of elytra less broadly flattened; apical edge entire........ .... 6. discolor.

b. Body beneath black, slightly bronzed; middle and hind feet, and frequently sides and tip of the abdomen, pale; elytra distinctly sinuated near the tip in the ♀, and sutural angle very prominent in that sex.

10·5—12 mm. Black, usually slightly bronzed, ♂ more shining than the ♀; middle and hind legs testaceous; margin and tip of abdomen pale; elytra feebly striate, sparsely and finely punctulate; (♂ with the elytra not sinuate near the tip, feebly sinuate at the tip; sutural angle slightly prominent; ♀ deeply sinuate on the side near the tip; margin elevated at the sinuosity, sinuate again at the tip, with the sutural angle very prominent.).. 7. assimilis.

Bibliography and remarks.

1. D. vittatus *Aubé*, Hydroc. 768; *Gyrinus vitt.* Germ. sp. nov. 32; *Cyclous opacus* Mels., Proc. Acad. Nat. Sci. Phila. ii, 29 (faded specimens). Middle and Southern States, not rare.

2. D. sublineatus *Aubé*, Hydroc. 775; *Gyrinus subl.* Chevr., Col. Mex. cent. i; ♀ *D. integer* Lec, Proc. Acad. Nat. Sci. Phila. vii, 221. Arizona and Lower California.

3. D. emarginatus *White*, Brit. Mus. Cat.; *Gyrinus emarg* Say, Trans. Am. Phil. Soc. ii, 108; ed. Lec. ii, 519; *D. americanus*‡ Aubé, Hydroc. 777 (nec. Linn.) Abundant in the middle and northern States; for remarks on Gyrinus americanus *Linn.*, showing its probable identity with the West Indian D. metallicus *Aubé*, see the note of Dr. Schaum in Stettin Ent. Zeit. 1848, 337.

4. D. carolinus. I have seen but two ♀ specimens, collected in South Carolina; it closely resembles the preceding, but is more shining, and the apical margin of the elytra, instead of being flat, is very narrowly reflexed.

5. D. serrulatus. Middle and Southern States. I have seen but two ♂♀ specimens of this species, which resembles in form D. assimilis, but is easily distinguished by the fine serration of the apical margin of the elytra, the sutural angle less prominent, the lateral flattened margin broader and more reflexed, the posterior sinuosity of the elytra of the female much less, the striæ of the elytra less visible, and finally by the front thighs of the male being armed with a strong sharp tooth.

6. D. discolor *Aubé*, Hydroc. 784; *Cyclous labratus* Mels. Proc. Acad. Nat. Sci. Phila. ii, 29. Abundant from Canada to Louisiana, and from Maine to Kansas; easily known by its narrower form and pale ferruginous under surface; the front thighs of the male are not toothed.

7. D. assimilis *Aubé*, Hydroc. 778. *Cyclinus ass.* Kirby, Fauna Bor. Am. iv, 78. *Gyrinus americanus* Say, Trans. Am. Philos. Soc. ii, 107; ed. Lec. ii, 519. Our most abundant species, usually known as *apple bug;* extends from Lake Superior to Texas, and from Maine to Kansas. The front femora of the male are not toothed.

Gyrinus Linn.

"The species of this genus, as at present defined, are peculiar in having 11 rows of punctures on each elytron, and an oval transverse figure limited by punctures near the tip. The legs are always ferruginous, or testaceous. Usually two frontal impressions and two thoracic transverse impressions are well defined, but they are not equally evident in every individual, and are sometimes entirely obliterated.

"For the better definition of the species it must be observed that in those in which the upper surface has a shining metallic gloss, the color becomes sometimes black, and sometimes in part dark brown; in the same proportion the black color of the breast and the abdomen varies to ferruginous. The obliteration of the rows of punctures next the suture is of doubtful specific value, as is also the size of the specimens, both of which characters are subject to great variations."—Zimmermann, MS. To this I may add that the frontal impressions are of no value in distinguishing species.

On account of the close resemblance between the species, it has been very difficult to identify them by the descriptions thus far published, and, as will be seen in the bibliography and remarks, the determinations are frequently different in each of the standard collections which have been independently formed in this country.

My own determinations are in some instances at variance with those of Dr. Zimmermann and Dr. Harris, and I hope may be sustained by reference to the types preserved in European collections; but at all events the possession of a much larger number of specimens, from more widely separated localities, has given me greater advantage in distinguishing and defining the forms to which specific names must, in the present condition of science, be given.

The species before me may be arranged in the following groups, the mesosternum being of normal form in all except p e c t o r a l i s:

A. Scutellum flat:

a. Under side margin of prothorax and epipleuræ testaceous.

b. Under side margin of prothorax and epipleuræ metallic black.

B. Scutellum finely but distinctly carinate:

(Under side margin of prothorax and epipleuræ testaceous.)

A—a.

* Under surface uniform testaceous, or brown.

6—6·75 mm. ♀. Elongate oval, polished black, more or less bronzed; punctures of the elytral rows approximate, rather fine; tip much rounded, outer angle not distinct.. .... 1. c o n f i n i s *Lec.*

6 mm. ♀. A little less elongated, polished black, not bronzed; punctures of the elytral rows stronger, and equally closely placed. 2. f r a t e r n u s *Couper.*

4·5—5 mm. Smaller, not very elongate, polished black; margins and sides broadly bronzed; punctures of outer elytral rows stronger and moderately approximate; abdomen sometimes dark at the middle...... 3. l i m b a t u s *Say.*

5·5 mm. ♀. More elongated, uniformly black bronzed; punctures of elytral rows rather strong, moderately approximate............... 4. a e n e o l u s, n. sp.

4·5—5 mm. Of the same form, color and sculpture as l i m b a t u s, scarcely bronzed and a little wider; the ventral segments of the abdomen in mature specimens are darker brown, the punctures of the elytral rows more approximate, with the last segment paler.................. ... 5. d i c h r o u s, n. sp.

5·25 mm. ♂. More elongate, strongly attenuated before and behind, and more elevated at the middle than usual, black, highly polished, broadly bronzed on the sides, but not on the suture or reflexed margin of the elytra; rows composed of larger bronzed punctures not very approximate, becoming coarser at the sides; tip truncate, slightly rounded; outer angle not very obvious; body beneath and legs ferruginous. (Easily distinguished by its more compressed convex form and coarser punctures.)........,..... .... 6. e l e v a t u s, n. sp.

5·5—6·5 mm. Elongate oval, more narrowed in front, black, highly polished; margins and sides slightly bronzed; tip of elytra more concave than usual; (margin not interrupted); rows of elytral punctures bronzed, well marked, approximate; under surface uniform reddish-brown. (Resembles c o n f i n i s, but is much larger and more narrowed in front, from the base of the elytra)........ ... . 7. c o n s o b r i n u s *Lec.*

5—6·5 mm. Of the same form, color and sculpture as c o n s o b r i n u s, but a little broader and with the reflexed margin of the elytra interrupted near the tip by a small flattened space, and the tip less rounded....... 8. p l i c i f e r *Lec.*

6·5—7 mm. Oval, less elongate, black, very highly polished, iridescent; margins and sides bronzed; rows of punctures of elytra well marked, approximate; under surface reddish-brown, sides and tip of abdomen a little paler. (A beautiful species, easily known by its larger size and more brilliant iridescent surface; in one specimen the under surface is nearly black.)
9. v e n t r a l i s *Kirby.*

6·5 mm. Similar in size, color and sculpture to v e n t r a l i s, and equally brilliant, but somewhat narrower in form, with the tip of the elytra more suddenly truncate, less rounded and with the outer angle obtuse, only slightly rounded and quite distinct...................................... 10. a q u i r i s, n. sp.

**Trunk dark piceous; abdomen with tip and lateral spots pale.

6—6·75 mm. More elongate than usual, black, highly polished, slightly iridescent; margins bronzed; punctures of elytral rows bronzed, fine, well marked, approximate; tip more rounded than usual...... 11. m a c u l i v e n t r i s, n. sp.

*** Trunk black bronzed, or piceous bronzed; tip of abdomen reddish-brown.

7·25—8 mm. Oval, less elongated, black, shining, but not polished, very minutely punctulate or rugose; margins bronzed; tips of elytra more concave than usual; punctures of rows well marked, approximate. (Easily distinguished by the fine punctuation of the upper surface and the bronzed color beneath.).. 12. affinis *Aubé.*

A—b.

a. Body oval in form, regularly convex.

* Anterior margin of mesosternum regular in form.

5·25—5·75 mm. Oval, equally attenuated at each end, black, shining, highly polished; margins and sides bronzed; elytra with rows of deeply impressed, bronzed, coarse punctures, so approximated that the outer striæ appear impressed; tip broadly subtruncate, feebly rounded; outer angle distinct. 13. parcus *Say.*

5·5—6·5 mm. Oval more elongate, nearly equally narrowed before and behind, black, shining, highly polished; margins and sides bronzed; elytral rows composed of approximate bronzed punctures, the outer ones a little stronger than the inner; tip of elytra strongly rounded, outer angle not distinct; last ventral segment sometimes dark reddish-brown; sides of prothorax slightly rounded.

α. Apical oval of punctured curve of elytra composed of large, coarse punctures.

β. Apical oval curve composed of very fine punctures, almost obliterated; middle and hind legs darker than usual.............. 14. picipes *Aubé.*

5·25 mm. Smaller and a little narrower than picipes, of a less shining black, feebly bronzed, more brilliantly at the margins and sides; elytral rows composed of less approximate bronzed punctures, the outer ones a little stronger than the inner; tip of elytra strongly rounded; outer angle not distinct; apical oval curve composed of distant, well marked punctures; middle and hind legs darker than usual................................ 15. opacus *Sahlb.*

7 mm. Larger and a little stouter, black, highly polished and with bluish reflections; margins and sides bronzed; elytral rows composed of fine bronzed, very closely approximated punctures, outer rows distinctly impressed; tip of elytra broadly truncate, feebly rounded; outer angle distinct, though obtuse and rounded; legs ferruginous, under surface black; last ventral segment very dark brown... 16. borealis *Aubé.*

6 mm. Of the same form, color and sculpture as the preceding, but still more highly polished; the elytra are still less rounded at tip, and the punctures of the rows are less fine and less approximate, and the outer rows, though a little stronger, are not impressed; the under surface is black, the last ventral segment ferruginous in one, but very dark brown in two other specimens; the legs ferruginous.. 17. pernitidus, n. sp.

6—7 mm. Of the size and form as borealis, but above black, less highly polished and not at all bronzed; tip of elytra more rounded, with the outer angle less distinct; the rows are composed of small but less approximate punctures, and the outer rows, though stronger, are not impressed; the under surface is black, feebly bronzed; the legs ferruginous, and the last ventral segment dark brown.. 18. lugens *Zim.*

5—6 mm. Smaller, more elongate, black bronzed both above and beneath; upper surface not highly polished; elytra with the tip broadly but not strongly rounded; outer angle not distinct; rows composed of not very fine, less approximate punctures, outer rows but little stronger than the inner ones; legs and last ventral segment ferruginous. (Resembles in form, size and sculpture G. opacus, but is more bronzed above and beneath, the legs and last ventral segment are paler and the inferior pair of eyes are larger.... 19. analis *Say.*

** Front margin of mesosternum trilobed, with an oblique impression each side.

5—6 mm. Oval, shining black, highly polished, margins and sides bronzed; elytra at tip moderately rounded; outer angle not distinct; rows composed of bronzed, approximate punctures, outer rows not stronger than the inner ones; beneath black, slightly bronzed; legs ferruginous, thighs darker. (Of the same size and form as G. limbatus and consobrinus, but easily recognized by the very peculiar form of the mesosternum.)........ 20. pectoralis, n. sp.

b. Body broader, subovate, more suddenly convex at the middle and obliquely declivous before and behind.

5·5 mm. ♀. Uniform black, bronzed above; elytra with the tip broadly truncate, feebly rounded, outer angle distinct but rounded; rows composed of fine approximate punctures, outer ones not stronger, lateral margin more broadly reflexed than usual. Beneath black, with slightly metallic reflection, last ventral segment dark brown, legs ferruginous; mesosternum feebly channeled for its entire length.. 21. gibber *Zim.*

B.

4—4·5 mm. Elongate oval, bluish black, not highly polished, sides broadly bronzed; elytra with the tip truncate, feebly rounded, outer angle somewhat distinct, though rounded; rows composed of approximate bronzed punctures, the outer ones stronger than the inner; under surface, inflexed margins and legs ferruginous, anterior ventral segments sometimes darker; mesosternum with a very deep median furrow.............................. 22. minutus *Linn.*

3·5—4·5 mm. Of the same size and form as minutus, but a little narrower and more convex and of a more dull black color, though slightly bronzed at the sides; prothorax more rugose, rows of the elytra composed of more approximate punctures, and especially distinguished by the mesosternum being but feebly channelled in front, with a large elongate posterior fovea; under surface always ferruginous yellow.

23. rockinghamensis *Zim.*

Bibliography and Remarks.

1. G. confinis. Similar in form to the Californian *G. consobrinus*, but less polished, with a slight bronzed color over the whole upper surface, more brilliant at the suture and margins. Abundant at Lake Superior. I have also several specimens from the interior of Oregon or Montana.

2. G. fraternus *Couper*, Canadian Naturalist, 2d ser. ii, 60. Canada and Lake Superior; for types I am indebted to Mr. W. Couper, late of Quebec, but now of Ottawa. Is of the same size as the preceding, but a little more robust, and easily distinguished by the entire absence of bronzed lustre on the upper surface, even at the suture and margin.

3. G. limbatus *Say*, Trans. Am. Phil. Soc. ii, 109; ed. Lec. ii, 520. Canada and Lake Superior. In one specimen the suture is not bronzed, and in one the abdomen is dark brown at the middle. I received from the late Dr. T. W. Harris a specimen of this species from Western New York, as No. 1642 of his collection, *G. analis* Say, and in Dr. Zimmermann's collection it is named *G. limbatus* Say. From the former it differs by the under surface being ferruginous. It is quite possible that the determination of Dr. Zimmermann is correct, and although I have seen no specimens from Georgia and Florida, the locality mentioned by Say, I have no other which agrees so nearly with his description, or which resembles in appearance *G. analis*, with which he compares it.

4. G. aeneolus. One specimen, Illinois, Mr. Willcox. This species is easily known by the uniform and tolerably brilliant bronze color of the upper surface, which, with the more elongate form and ferruginous under surface perfectly defines it.

5. G. dichrous. New England. I received this species from Dr. Harris as bearing the name in the Melsheimer collection; specimens under the same name are contained in Dr. Zimmermann's cabinet, now in possession of Dr. Samuel Lewis. It closely resembles G. limbatus, but is a little more robust, and not bronzed on the margin and suture.

6. G. elevatus. One specimen, New York, No. 1829 Harris' collection. Very distinct by its more convex elevated body, more strongly attenuated at each end, and by the much coarser punctures of the outer elytral rows.

7. G. consobrinus *Lec.* Ann. Lyc. Nat. Hist. New York, v, 209. Abundant in California, at San Francisco, Mendocino, &c.

8. G. plicifer *Lec.*, ibid. California, not abundant. Easily known by the reflexed edge of the elytra being interrupted near the tip by a slight depression, so that the appearance of a small fold is produced, extending from the small depression to the apical truncation. I received from Mr. A. Murray a smaller specimen, which agrees sufficiently with the description of *G. marginiventris* Motsch., Bull. Mosc. 1859, ii, 174, to induce me to place the latter as a synonym.

9. G. ventralis *Kirby*, Fauna Bor. Am., iv, 80; Aubé. Hydroc. 672. A common species from Pennsylvania, northward to Lake Superior; in the Zimmermann collection it is determined as *G. ventralis* Kirby, but although agreeing in other respects with Kirby's description it seems generally too large to be referred to the latter, which is compared with G. aeneus, a much smaller species. Specimens occur in which the under surface is chestnut brown, with the inflexed margins, the sides and tip of the abdomen and the legs paler ferruginous; *G. limbatus* ‡ Aubé, 670 (nec Say), is considered by Dr. Zimmermann to belong to this species.

10. G. aquiris. Middle States; differs from the preceding in the narrower form, and more squarely truncate elytra; the under surface is darker brown, in one specimen nearly black, with the inflexed margins, sides and tip of abdomen, and feet paler ferruginous; it is less elongate than the next species and the pale color of the sides of the ventral segments is not arranged in spots but is diffused. On account of the more sudden truncation of the tips of the elytra I would refer *G. limbatus* ‡ Aubé to this, rather than to the preceding species.

11. G. maculiventris. Abundant at Lake Superior; one specimen from Montana; more elongate than usual, and easily recognized by the dark brown color of the under surface, with well marked pale triangular spots each side on the ventral segments.

12. G. affinis *Aubé*, Hydroc. 669. New York to Lake Superior; I have also two specimens from Middle California. Our largest species, easily distinguished by the upper surface of both sexes, (not alone of the ♂ as mentioned by Mr. Aubé), being covered with very fine lines, producing under a high lens an aciculate appearance. I received from Dr. Harris one specimen as No. 819 var. *G. limbatus* Say., *teste* Say, but its much larger size, as well as the dark bronzed color of the greater part of the under surface, completely separate it from that species.

13. G. parcus *Say*, Trans. Am. Phil. Soc., iv, 448; ed. Lec. ii, 562; *Aubé*, Hydroc. 701. Two specimens from Texas agree with the descriptions of this species; they differ from the other small species having the under surface black bronzed, by the more coarse punctures of the elytral rows, the outer ones of which become, by the approximation of the punctures, slightly impressed.

14. G. picipes *Aubé*, Hydroc., 694; *Mannh.* Bull. Mosc. 1843, 223; ibid., 1853, ii, 164. Alaska and Oregon. I have three specimens collected in Labrador, one of which does not seem to differ from the types from Alaska kindly sent me by Baron Chaudoir and Count Mnizech; in one of the speci-

mens the inflexed margins are slightly tinged with dark reddish brown, as mentioned in the remarks of Mannerheim under the second reference. Two specimens (♂ ♀) from Labrador, are much smaller, only 5·25 mm. long, but do not seem to differ in any other respect; var. b, of the last reference, is probably a distinct species, but I have seen no specimen to correspond with it.

α. A race of this species is represented by four specimens from Lake Superior, which resemble in appearance the typical *G. picipes*, but differ only by the apical crescentic oval curve of the elytral being composed of larger punctures. This differs from the others of the same group (except *pernitidus*) by the more elongate form, more highly polished surface, and more brilliantly bronzed suture, margin and punctures; G. pernitidus is more highly polished, but has the elytral rows composed of less approximate punctures; G. borealis is larger and stouter than the two species in question, though otherwise resembling them very closely.

15. G. opacus *Sahlberg*, Ins. Fenn., 47; *Schiödte*, Naturhist. Bidrag. Grönland, p. 54; *G. æneus* Aubé, Hydroc. 690, (fide Redtenbacher). Mr. Drewsen, of Copenhagen, has kindly sent me three specimens of this species, with a very complete series of the other Coleoptera of Greenland. *G. æneus* Kirby, Fauna. Bor. Am. iv, 80, must according to the size given (2 4-5th lin.) be a much larger species, which is unknown to me, unless it be *G. borealis*.

16. G. borealis *Aubé*, Hydroc. 692. New York to Lake Superior; the distinguishing characters of this have been sufficiently pointed out in the remarks upon other species.

17. G. pernitidus. The type of this species is a single ♀ from Georgia; with it I have associated two other females sent me by Dr. Harris, as No. 242, *analis?* Say; one of the specimens agrees perfectly with the type, while in the other the punctures of the rows of the elytra are much less approximate, the inner rows less strongly marked, and the last ventral segment nearly black, instead of ferruginous, as in the type; it is probably a distinct species, and is perhaps a small specimen of *G. Sayi* Aubé, 698, which is otherwise unknown to me.

Dr. Zimmermann determined this as *G. borealis*, but the size given in the description of Mr. Aubé (7 mm.) represents a larger speices, and I have accordingly referred it to the preceding.

18. G. lugens *Zimm.* MS. New England and Lake Superior; easily known by the larger and stouter form, similar to *G. borealis*, but not at all bronzed above.

19. G. analis *Say*, Trans. Am. Phil. Soc., ii, 108; ed. Lec. ii, 520; ibid. iv, 448, ed. Lec. ii, 562; *Aubé*, Hydroc. 697. Louisiana to Lake Superior, easily distinguished by the upper surface uniformly bronzed; the under surface black bronzed, with the last ventral segment and feet ferruginous; the form is narrower than in the other species of this group, except *G. opacus*, which is, however, less oval and more narrowed behind.

20. G. pectoralis. Lake Superior and Hudson Bay Territory, (Fort Liard).

21. G. gibber *Zimm.*, MS. I have seen but the single specimen of this peculiar species found in North Carolina by Dr. Zimmermann, from whose MS. I have translated the description; this unique specimen was kindly given to me by Dr. Samuel Lewis.

Bibliography and remarks.

22. G. minutus *Fabr.*, Syst. El. i, 276; *Kirby*, Fauna Bor. Am. iv, 81; *Aubé*, Hydroc. 683. Lake Superior, abundant. I have omitted much of the European synonymy of this species, as not applicable to our fauna; it is, however, necessary to observe that the fine carina of the scutellum which distinguishes this and the next, so far as I know, from all others of the genus

is not mentioned by the authors above cited, nor by Redtenbacher; but attention is called to it in the description of Thomson, Skandiv. Coleoptera, ii, 117.

23. G. rockinghamensis *Zimm.*, MS. Dr. Zimmermann mentions in his MS. that he found this species in schools of several thousands, in ponds at Rockingham, North Carolina. I have translated the description from his notes.

Species not identified.

G. impressicollis *Kirby*, Fauna Bor. Am. iv, 79. Mr. Adam White, B. M. Cat. 45, refers this to *G. borealis* Aubé, but the great size, unless an error of print, (4 lines, = 8·3 mm.) renders such reference very improbable.

G. Sayi *Aubé* Hydroc. 698. See remarks under No. 17.

G. fuscipes *Motsch.* Bull. Mosc. 1859, ii, 173. California; perhaps *G. consobrinus* Lec.*

GYRETES Brullé.

1. G. sinuatus, elongate oval, very convex, dark bronzed, very shining; sides of prothorax and elytra densely punctured and pubescent, punctures reaching the suture; tip of elytra broadly and obliquely truncate, outline of the truncation very slightly but distinctly sinuate, outer angle distinct, slightly prominent, inflexed margins ferruginous; body beneath and legs ferruginous, breast and base of abdomen darker. Long. 6 mm. Lec. Ann. Lyc. Nat. Hist., New York, v, 210.

Abundant in the Colorado River, near Fort Yuma, California.

2. G. compressus, still more elongate, and more convex than the preceding, and more narrowed in front than behind, dark bronzed, shining; sides of prothorax and elytra densely punctured and pubescent, punctures not quite reaching the suture; tip broadly and obliquely truncate and very feebly sinuate, outer angle obtuse, distinct, slightly prominent, inflexed margins black; body beneath dark brownish red, feet and tip of abdomen paler. Long. 6·75 mm. Lec., New Spec., North Am. Col., (Smith's Inst.) 23.

One specimen collected at Quincy, Illinois, by Mr. Willcox.

Notes on the Species of AGONODERUS, BRADYCELLUS and STENOLOPHUS inhabiting America north of Mexico.

BY JOHN L. LE CONTE, M. D.

The final demolition of the genus *Acupalpus* Dej. seems to have been accomplished by Baron Chaudoir, in his recent notes upon North American Carabidæ,† by the reference of most of the species contained in my third division of Stenolophus‡ to *Agonoderus*. In fact, his suggestion is so perfectly natural, that it is strange that the resemblance in form and sculpture, and in the proportion of the joints of the hind tarsi, with the absence of sexual characters in the front tarsi, did not long since cause these species to be placed in the proper position to which he has assigned them.

In reviewing the specimens of my collection with the aid of the remarks of my learned friend, I have found such resemblances in form between the species

* Mr. Uhler has sent me a portion of a large school of Gyrinus, collected in Charles River, near Cambridge, Mass., which shows that in some cases at least the species do not live apart. An examination of all the individuals captured has given me the following results:—

G. limbatus,	4 ♂, 5 ♀.	G. fraternus,	2 ♂, 2 ♀.
G. dichrous,	5 ♂ 6 ♀.	G. picipes? (race),	5 ♂ 3 ♀.
G. confinis,	12 ♂ 7 ♀.	G. lugens,	18 ♂ 4 ♀.

I have observed at Lake Superior, however, that the species are generally not found intermixed.

† Revue et Mag. de Zoologie, 1868.

‡ Vide List of Coleoptera, North Am., p. 13.

of the three genera above named, that a brief synopsis of the distinguishing characters of those which I have investigated seems to me to be useful for the proper naming of the specimens contained in local cabinets.

I may also add that the determinations of Baron Chaudoir, who is the fortunate possessor of the Dejeanian types, must be taken as conclusive, regarding the species of that author; the original descriptions were unfortunately defective in some respects, and my recognition of his species was therefore erroneous.

In all the species mentioned in this synopsis, except Bradycellus dichrous, vulpeculus and autumnalis, the marginal line limiting the bead of the prothorax is obliterated for a greater or less extent at the middle of the base, but in those three species it is entire, as in the true Harpali, with which, perhaps, they should more properly be associated.

AGONODERUS Dej.

In the species of this genus the emargination of the mentum is less semicircular in outline than in *Stenolophus*, but equally destitute of any vestige of a tooth; the sides of the emargination are more oblique and the bottom therefore narrower, like a broadly rounded angle; the body is rather stouter and more convex, the joints of the antennæ thicker, the hind tibiæ and tarsi less slender, the joints 1—4 of the latter diminishing in length less rapidly, the front tibiæ stouter and more strongly spinose near the tip, and finally the front tarsi are alike in form in both sexes and in the more slender species thinly clothed with a few papillæ.

Our species, all but one of which, as far as known, are represented in my collection, diminish gradually in size, and may be grouped as follows, the dorsal puncture being wanting only in A. infuscatus:

A. Body stouter and more convex: prothorax transverse, quadrate-oval.

a. Hind angles of prothorax very much rounded.

7—8·5 mm. Pale yellow above; prothorax with two discoidal spots; scutellar stria long; elytra with two dark stripes separated by the sutural interval; dorsal puncture distinct.................................... 1. lineola.

6·5 mm. Dark testaceous or piceous, narrow margin of prothorax and broader one of elytra pale; scutellar stria shorter; dorsal puncture wanting.. 2. infuscatus.

b. Prothorax nearly quadrate; hind angles obtuse, slightly rounded; sides less rounded.

8 mm. Pale yellow; head behind the eyes black, with an occipital round yellow spot; prothorax with two discoidal oval black spots; base finely and not densely punctured; elytra with two dark stripes, as in *lineola;* scutellar stria long. (Differs from *lineola* chiefly by the form of the prothorax.) California, and Nevada.. 3. maculatus, n. sp.

B. Body more elongate, less convex; prothorax scarcely wider than long; subtrapezoidal, being more or less distinctly narrowed behind; elytra with one dorsal puncture.

a. Larger species; color pale; elytra with a wide black stripe, divided by the suture; disc of prothorax frequently with a large black spot; head always black.

5·5—6 mm. Hind angles of prothorax rounded; scutellar stria long. 4. comma.

5·5—7 mm. Hind angles of prothorax scarcely rounded; scutellar stria short.. 5. pallipes.

7 mm. Sides of prothorax subsinuate behind; hind angles rounded: scutellar stria short? (interrupted in the only specimen I have seen); hind tarsi stouter than in *pallipes*. California................................ 6. rugicollis.

b. Smaller species.

* Head black; scutellar stria distinct.

3·5—4 mm. Prothorax pale; hind angles much rounded; basal impressions with a few coarse punctures; elytra with a broad, dusky stripe or cloud, divided by the sutural interval; body dusky beneath......... 7. partiarius.

3—3·25 mm. Very similar to partiarius, but smaller, with the basal impressions less marked, and still more sparsely punctured; elytra dusky, with the suture and margins pale; prothorax pale above and beneath; trunk always and abdomen usually dusky..... .... 8. pauperculus.

3—4 mm. Equal in size to *partiarius*, but narrower, with the sides of the prothorax not rounded behind, but even feebly subsinuate; the hind angles are, however, rounded, the disc marked with a large, quadrate, blackish spot; elytra blackish, with the suture and margin testaceous; scutellar stria longer than in partiarius.............. .... 9. indistinctus.

** Head pale, of the same color as the prothorax; body testaceous or ferruginous beneath, not blackish; scutellar stria short or wanting.

2·5—3 mm. Prothorax with the hind angles much rounded; basal impressions faint, marked with a few large punctures; elytra with the scutellar stria punctiform; disc sometimes with a faint dusky cloud........ 10. testaceus.

2·75 mm. Of the same size and form as the preceding, with the scutellar stria distinct though short, not punctiform............. .... 11. micros.

Bibliography and remarks.

1. A. lineola *Dej.*, Sp. Gen., iv, 51; *Carabus lineola* Fabr., Ent. Syst., i, 155; Syst. El., i, 197; Oliv., 35, 78, pl. 7, f. 75; *Feronia lineola* Say, Tr. Am. Phil. Soc., ii, 37; ed. Lec., ii, 464; *Carabus furcatus* Fabr., Ent. Syst., i, 164; Syst. El., i, 206, (var. thorace immac.)

Carabus comma *Fabr.* cannot be referred to this specis, as is erroneously stated in the Melsheimer Catalogue and thence copied into my List, since it is described as having the head black.

2. A. infuscatus *Dej.*, Sp. Gen., iv. 54; *suturalis* Lec., Ann. Lyc. New York, iv, 373.

4. A. comma. *Carabus comma* Fabr., Ent. Syst., 1, 165; Syst. El., i, 207; *Feronia pallipes* Say, Trans. Am. Phil. Soc., ii, 38; ed. Lec , ii, 465; *A. pallipes* Dej , Sp. Gen., iv, 53; *A. dorsalis* Lec., Ann. Lyc. N. York, iv, 373.*

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* The MS. descriptions and remarks of Dr. Zimmermann upon this and the next species are so important that I have translated them:

"A. comma. Abundant in the Northern States; $2\frac{3}{4}$—$3\frac{1}{2}$ lines long.

"Altogether similar to A. pallipes in form and color, and usually confounded with it; differs in the marking of the elytra, upon each of which there is a black stripe, so that the suture remains yellow; this stripe extends from the first to the fifth stria, and is commonly abbreviated in front, sometimes, however, attaining the base, but never the suture. The dorsal spot of the prothorax is sometimes wanting; the hind angles are somewhat more obtuse, and the scutellar stria of the elytra longer than in the next species.

"A. pallipes. Abundant in the Southern States; 2—3 lines long.

"Body elongated, not very convex, testaceous; mouth, palpi, base of antennae, feet and anus reddish-yellow; under surface and head black; a large black or brown spot on the middle of the prothorax, and a broad black stripe on the elytra, which extends from the suture to the fourth stria, pointed in front and reaching the scutellum. Head with deep frontal impressions and moderately large eyes; prothorax narrowed behind; hind margin and shallow basal impressions thickly punctured; hind angles rather obtuse than rounded; elytra wtth deep, smooth striae, short scutellar stria and a distinct posterior dorsal puncture upon the second stria.

"*Remarks.*—It is obviously this species and not the preceding which Fabricius described from the Hunterian collection. This is apparent, not only in the words 'Coleoptera nigra limbo pallido,' but also by the description and figure given by Olivier under the same name, with the additional remark that the insect was found in Carolina. *A. pallipes* Dej. is another species which is found in the Northern States, and described by Fabricius under the name *Car. comma* in the following words: 'Elytra grisea, macula lineari nigra versus suturam.'" The specimen of *Carabus pallipes* in the Fabrician cabinet is a *Cymindis variegata* Dej., according to Schaum. Stettin Ent. Zeitung, 1847, 47.

5. A. pallipes *Lec.*, Ann. Lyc. N. York, iv, 373; *Carabus pallipes* Fabr., Ent. Syst., i. 159; Syst. El., i, 200; Oliv., 35, 121, pl. 9, f. 99; *A. Lecontei* Chaud., Rev. and Mag. Zool., 1868.

6. A. rugicollis *Lec.*, Proc. Acad. Nat. Sci., Phil., 1859, 83.

7. A. partiarius *Chaud.*, Rev. and Mag. Zool., 1868; *Trechus part* Say, Trans. Am. Phil. Soc., ii, 90; ed. Lec., ii, 504. Dr. Zimmermann believed that he recognized in this species *Carabus celer* Oliv., 35, 114, pl. 14, f. 168, to which the locality "Paris" was incorrectly given; he supposed that the specimen was found in Carolina by Bosc., from whose collection it was described.

8. A pauperculus *Chaud.*, Rev. and Mag. Zool., 1868; *Acupalpus paup.* Dej., Sp. Gen., iv, 463, *Ac. consimilis* Dej., ibid., iv, 465.

9. A. indistinctus *Chaud.*, Rev. and Mag. Zool., 1868; *Acupalpus ind.* Dej., Sp. Gen., v, 846. Dr. Zimmermann determined this species as Ac. humilis *Dej.*, ibid., iv, 462, which is referred by Chandoir to *Stenolophus*; with about twelve specimens before me, I can perceive no greater sexual differences than those observed in other small species of this genus; a specimen determined by Zimmermann as Ac. difficilis *Dej.*, Sp. Gen., iv, 435, does not differ, except in being of a uniform pale brown color and scarcely perceptibly more elongated. Should this synonymy be correct the species must be called A. humilis, the specific name under which it was first published.

10. A. testaceus *Chaud.*, Rev. and Mag. Zool., 1868; *Acupalpus test.* Dej., Sp. Gen., iv, 460.

11. A. micros *Lec.*, Ann. Lyc. N. York, iv, 412. My description mentions the only distinguishing character between this and the preceding, which is, that the scutellar stria, though short, is quite obvious.

STENOLOPHUS Dej.

In this genus the mentum is semicircularly emarginate, without median tooth; the front and middle tarsi of the male are dilated, and furnished beneath with two rows of squamiform papillæ The form of the dilated joints enables the species to be divided into natural groups. Until the male is known, it is somewhat difficult to decide whether some of the smaller species should be referred to this genus or to *Agonoderus*; but in doubtful cases, in the absence of specimens with dilated front tarsi, I have referred to *Stenolophus* all those in which the first and second joints of the hind tarsi are much longer than the third and fourth; in other words, those in which the hind tarsi are more slender, and the joints diminish in length more rapidly than in *Agonoderus*.

Our species may be grouped as follows:

A. Body rather stout, prothorax but little narrower than the elytra; front and middle tarsi of male broadly dilated; fourth joint very deeply bilobed; scutellar stria long.

a. Sides of prothorax broadly flattened, scarcely reflexed.

7·5 mm. Black, not very shining; 1st joint of antennæ, tibiæ and tarsi brownish.. 1. carbonarius.

b. Sides of prothorax less broadly flattened, more strongly reflexed.

6·5 mm. Piceous black, shining; base of antennæ, margin of prothorax, epipleuræ and feet brown: basal impressions of thorax feebly and sparsely punctured.. 2. spretus.

c. Prothorax narrowly margined, margin not reflexed.

6·5—7 mm. Piceous with brassy lustre, margins of thorax and elytra testaceous, base of antennæ and feet more or less brown; prothorax subquadrate; basal angles nearly rectangular, rounded at tip, impressions finely punctured and rugose.. 3. limbalis.

7—7·5 mm. Black, shining, elytra piceous or testaceous, slightly iridescent, base of antennæ and feet more or less testaceous or brown; prothorax feebly narrowed behind, hind angles obtuse rounded, basal impressions with a few scattered punctures, bead of lateral margin pale.............. 4. fuliginosus.

5·5 mm. Black shining, base of antennæ and feet ferruginous, elytra slightly iridescent, margin brown; prothorax with the lateral bead brown, feebly narrowed behind, hind angles much rounded, basal impressions rounded, impunctured .... 5 plebejus.

3·5—4·5 mm. Smaller, piceous shining, sides of elytra and disc of prothorax frequently ferruginous, base of antennæ and feet ferruginous; prothorax feebly narrowed behind, hind angles very much rounded, not at all apparent; basal impressions small, rounded, feebly impressed, impunctured,
6. conjunctus.

4·5 mm. Similar to *conjunctus*, but narrower; black shining, margins of prothorax and elytra brown, base of antennæ and feet ferruginous; prothorax scarcely wider than long, not narrowed behind, hind angles much rounded, not at all apparent, basal impressions punctiform.................. 7. rotundatus.

B.

Body more slender, prothorax evidently narrower than the elytra, front tarsi of male moderately dilated, 4th joint deeply bilobed, middle tarsi of male not dilated; elytra with long scutellar stria, more or less iridescent; base of antennæ and feet pale; hind angles of prothorax obtuse rounded.

a. Elytra more finely striate, middle tarsi of male with two rows of squamiform papillæ. (Pacific species.)

* Striæ deeper towards the tip.

6 mm. Blackish, with the margins paler; prothorax wider than long, scarcely narrowed behind, basal impressions broad, very feebly punctured.
8. anceps

6·5 mm. Elytra black, with narrow pale margin; prothorax scarcely wider than long, narrowed behind, basal impressions faint, feebly punctured, disc yellow, with a large, somewhat bi-lobed black spot (elytral striæ deeper than in the preceding and next species)................................ 9. cincticollis.

** Striæ not deeper towards the tip.

4·5—5·27 mm. Beneath and head blackish, antennæ, feet, prothorax and elytra testaceous; prothorax wider than long, narrowed behind, basal impressions narrow, not punctured; elytra with a faint dusky cloud behind the middle .... 10. unicolor

b. Elytra more deeply striate, striæ deeper towards the tip, middle tarsi of male without rows of squamiform papillæ.

8·5 mm. Larger, blackish, with the margins paler; prothorax wider than long, with the basal impressions broad, finely punctured....... 11. flavipes.

5·5—5·75 mm. Smaller, blackish, narrow margins paler, prothorax scarcely wider than long, basal impressions broad, sparsely but less finely punctured.
12. ochropezus.

5·5—7 mm. Prothorax testaceous, hind angles more rounded, basal impressions sparsely punctured; elytra iridescent black, with very wide testaceous side margin.......... .... 13. dissimilis.

C.

Small species of elongate form; front tarsi of ♂ moderately dilated, fourth joint deeply emarginate, middle tarsi feebly dilated, with two rows of squamiform papillæ; elytra with long scutellar stria, base of antennæ and feet pale; hind angles of prothorax obtuse or subrectangular, less rounded than in B.

a. Elytra with but one dorsal puncture, as usual, on the second stria; hind angles of prothorax obtuse, somewhat rounded; frontal suture more distinct than usual.

3 mm. Head narrower than the prothorax, and almost as long; color scarcely brown, elytra darker, slightly iridescent, prothorax trapezoidal, but little broader than long, narrowed behind, rounded on the sides only before the middle; basal impressions broad, feebly punctured; eyes not prominent. 14. h y d r o p i c u s.

2·5—3 mm. Head more distinctly narrower than the prothorax, with larger and more prominent eyes, otherwise quite similar to *hydropicus*, but more elongate and less convex; color variable, but the head is always dark and the elytra iridescent.. 15. c a r u s.

b Elytra with several dorsal punctures; hind angles of prothorax rectangular, not rounded.

4 mm. Elongate, more depressed, head blackish, prothorax pale, with a large quadrate dusky spot; anterior transverse impression deeply marked, basal impressions broad, rugosely punctured; elytra pale, with a broad dorsal vitta divided by the suture and abbreviated at each end; dorsal punctures 3. Georgia, one specimen.................................... 16. f l a v i l i m b u s, n. sp.

3 5 mm. Smaller and less depressed; head blackish, prothorax testaceous, basal impressions deeper, feebly punctured, elytra dusky, with the suture, base and margin testaceous; dorsal punctures 3....................... 17. l o n g u l u s.

3—3·25 mm. Still smaller, prothorax as long as wide, with the sides still more subsinuate behind, and the hind angles more prominent; basal impressions deep, punctured; color brown or blackish, paler at the margins; dorsal punctures 4.. 18. r e c t a n g u l u s.

D.

Body more elongate and linear than in any of the preceding species: head as wide and nearly as long as the prothorax; front tarsi of ♂ moderately dilated, 4th joint bilobed, middle tarsi slightly dilated; prothorax narrowed behind, with flattened rectangular angles; elytra with long scutellar stria; palpi longer and more pointed than in the other groups of PHILODES Lec.

a. Elytra each with three distinct rows of dorsal punctures.

4·25 mm. Testaceous, head and part of elytra dusky; basal impressions of prothorax large, deep, not punctured; body depressed; eyes small. 19. a l t e r n a n s.

b. Elytra with the rows of dorsal punctures obsolete, only the posterior puncture of the second stria obvious.

4·25 mm. Dark brown, prothorax paler, with the basal impressions less deep, but also not punctured; body less depressed, eyes larger and more prominent.. 20. t e n e r.

Bibliography and Remarks.

1. S. c a r b o n a r i u s *Brullé*, Lec. Ann. Lyc. N. York, iv, 409; *Harpalus carb.* Dej., Sp. Gen. iv, 398.

2. S. s p r e t u s *Dej.*, Sp. Gen. v, 845.

3. S. l i m b a l i s *Lec.*, Rep. Pac. R. R. Surv., xi, 2, Ins. 28; *S. indistinctus* Motsch. Bull. Mosc., 1859, 2, 134.

4. S. f u l i g i n o s u s Dej., Sp. Gen., iv. 423; Lec. Ann. Lyc. N. York, iv, 410; *S. versicolor* Kirby, Faun. Bor. Am., iv, 46; *S. fuscipennis* Lec., Ann. Lyc., N. York, iv, 410.

5. S. p l e b e j u s *Dej.*, Sp. Gen., iv, 424; var. immat. *S. fuscatus* Dej., ibid. 426.

6. S. c o n j u n c t u s *Lec.*, Ann. Lyc., N. York, iv, 410; *Trechus conj.* Say, Trans. Am. Phil Soc., ii, 90, ed. Lec. ii, 504; *Acupalpus misellus* Dej., Sp. Gen. iv, 467; *Ac rotundicollis* Hald., Proc. Acad. Nat. Sc., Phil, i, 302; *Ac. lugubris*, Hald., ibid., i, 302. Found from the Atlantic to the Pacific.

7. S. r o t u n d a t u s *Lec.*, New. Sp. Col., (Smiths. Inst.), 17.

8. S. anceps *Lec.*, Pac. R. R. Expl., xi, 2. 28; *S. rotundicollis* Motsch. Bull. Mosc. 1859, ii, 135.

9. S. cincticollis *Lec.*, Proc. Acad. Nat. Sc., Phil., 1858, 60.

10. S. unicolor *Dej.*, Sp. Gen., iv. 411; Mannh. Bull. Mosc., 1843, 214.

11. S. flavipes *Lec.*. Proc. Acad. Nat. Sc., 1858, 60.

12. S. ochropezus *Dej.*, Sp. Gen., iv, 424; *Feronia ochr.* Say, Trans. Am. Phil. Soc., ii, 54; *S. convexicollis* Lec., Ann. Lyc., N. York, iv, 404.

13. S. dissimilis *Dej.*, Sp. Gen., iv, 424.

14. S. hydropicus *Lec.*, New Spec. Col. (Smiths. Inst.), 17.

15. S. carus *Lec.*, ibid., 18.

17. S. longulus *Lec.*, List Col. N. Am., 13; *Acupalpus long.* Dej., Sp. Gen., iv, 459.

18. *Acupalpus* rectangulus *Chaud.*, Rev. and Mag. Zool., 1868.

19. S. alternans *Lec.*, Trans. Am. Phil. Soc., x, 386; *Badister testaceus*|| Lec. Proc. Acad. Nat. Sc., Phil., ii, 252; *Aepus test.* Lec. Ann. Lyc., N. York, iv, 413, *Philodes alt.* Lec., Class. Col. N. Am., 1, 33.

20. S. tener *Lec.*, Pac. R. R. Expl., xi, 2, Ins. 29; *Philodes tener* Lec., Class. Col. N. Am., i, 33.

BRADYCELLUS Er.

The elytra are obliquely but feebly sinuate at tip, and never subtruncate as in the species of *Stenolophus.*

This genus contains both large and very small species, and, like Stenolophus, may be divided into groups according to the dilatation of the male tarsi; it may be distinguished from the other two genera by the mentum being armed with a large acute tooth, though in some of the smaller species it is sometimes difficult to perceive this character without the aid of a compound microscope; and even then the tooth is sometimes rendered less apparent, when the ligula is extended, by the basal portion of that organ; I believe. however, that I have by careful examination satisfied myself of the existence of the mentum-tooth in all of the species which I now refer to the genus.

Some of the smaller species of division B closely resemble in appearance *Agonoderus*, but may be usually known by the more slender antennæ and hind tarsi, and by the much shorter scutellar stria, which is sometimes in fact entirely wanting; a reference to the mentum, to verify the proper character belonging to the genus, should be always made in doubtful cases.

Baron Chaudoir regards the 1st division as constituting a distinct genus, *Tachycellus* Moravitz, but in view of the sexual differences observed in *Stenolophus*, I am scarcely prepared to adopt his opinion; I prefer therefore, for the present, to group the species as follows:

A. Front tarsi of male moderately dilated, middle tarsi less dilated, with two rows of squamiform papillæ beneath; elytra with a long scutellar stria.

a. Basal bead of prothorax well defined for its whole extent.

10—11 mm. Ferruginous, elytra black, iridescent, deeply striate; prothorax scarcely narrowed behind, sides broadly rounded and widely depressed, hind angles obtuse, somewhat rounded; base finely punctured.... 1. dichrous.

9—10 mm. Color as in the preceding; prothorax narrowed behind, sides rounded in front, oblique behind; hind angles scarcely rounded; base finely punctured; basal impressions more strongly marked........2. vulpeculus.

8 mm. Black; prothorax narrowed behind with small basal impressions, hind angles obtuse, not rounded; antennæ and feet ferruginous. 3. autumnalis.

b. Basal line of prothorax interrupted or nearly obliterated at the middle.

5—6 mm. Blackish; bead of prothorax pale; elytra piceous or dark testaceous; body more slender; prothorax distinctly narrowed behind; hind angles obtuse rounded; basal impressions well marked, sparsely punctured; legs ferruginous, thighs and tips of tibiæ sometimes darker; 1st joint of antennæ pale.. 4. badiipennis.

7 mm. Black; prothorax and elytra testaceous, the former with a large quadrate black spot, the latter with a dusky cloud divided by the suture; body slender; prothorax distinctly narrowed behind; hind angles subrectangular, slightly prominent, not rounded; basal impressions broad, punctured; antennæ with joints 1—3 testaceous, legs testaceous.

5. atrimedius.

4·5 mm. Smaller, slender, ferruginous, upper surface pale, with the head and disc of elytra somewhat darker; prothorax distinctly narrowed behind; hind angles subrectangular, slightly prominent, not rounded; basal impressions broad punctured; antennæ with the joints 1—3 or 4 paler.

6. nebulosus.

5·5—6 5 mm. Black, shining, not iridescent; prothorax with the hind angles rectangular; basal impressions linear, strongly marked, smooth, or scarcely punctured; anterior transverse impression distinct, strongly angulated; upper part of tibiæ and 1st joint of antennæ dark testaceous.

7. nigrinus.

5 mm. Smaller than *nigrinus*, with the hind angles of prothorax distinctly obtuse, but not rounded; otherwise not different; perhaps only an individual variation.. 8. tibialis.

B.

Species of small size with the scutellar stria very short, or altogether wanting; front tarsi of male moderately dilated, middle tarsi not dilated nor furnished with squamiform papillæ.

a. Striæ of elytra perfect.

* Head finely and sparsely punctured behind.

5 mm. Black or piceous shining; prothorax wider than long, slightly narrowed behind, much rounded on the sides; hind angles rounded; basal impressions well marked, feebly punctulate; elytra with the humeri and sometimes the sides paler brown; base of antennæ brown... 9. axillaris.

4·5—5 mm. Blackish, with the first joint of antennæ, feet and elytra more or less testaceous; prothorax at tip and base sparse punctured, formed as in the preceding, but less rounded at the sides and hind angles; basal impressions well marked; elytra (when pale marked with a dusky dorsal cloud, when dark, with the suture and sides paler,) thinly clothed with short pubescence near the sides and tip; intervals usually sparsely and distinctly punctured at the sides, base and tip; (α. larger and broader, testaceous, trunk dusky; elytra scarcely punctulate, *B. nitens* Lec.)........... 10. cognatus.

* * Head not punctulate; basal impressions of prothorax feeble.

† Basal impressions of prothorax smooth.

5 mm. Black, 1st joint of antennæ and feet testaceous yellow; prothorax much rounded on the sides, slightly narrowed behind; hind angles obtuse, scarcely rounded; basal impressions very feeble; scutellar stria entirely wanting.. 11. cordicollis.

† † Basal impressions of prothorax punctulate; scutellar stria represened by a puncture at the base of the 2d stria. Body elongate.

4—4 5 mm. Dark reddish testaceous, trunk black, antennæ with first two joints pale; prothorax a little wider than long, narrower behind, sides oblique near the base, but not sinuate; hind angles obtuse, almost rounded, not at all prominent; basal impressions broad, shallow, sparsely punctured; (only differs from the next by the hind angles of the thorax not being prominent, and is probably a race of it.).. 12. congener.

4—4·5 mm. Usually testaceous, sometimes piceous, with pale margins; base of antennæ and feet yellow; prothorax a little wider than long, narrowed behind; sides subsinuate very near the hind angles, which are obtuse not rounded and slightly prominent ; basal impressions broad, shallow, strongly punctured.. 13. rupestris.

4—4·25 mm. Blackish, margins brownish, feet and first two joints of antennæ yellow ; prothorax as in *rupestris*, from which this species differs only by its darker color and more elongated form, and of which it seems to me to be a race.. 14. parallelus.

3·75 mm. Smaller, pale testaceous, metasternum and small elytral cloud dusky ; prothorax nearly as wide as long, narrowed behind ; sides obliquely subsinuate behind the middle ; hind angles rectangular, not at all rounded ; basal impressions broad, sparsely and finely punctured........... 15. rivalis.

3·75 mm. Less elongate than the others of this group ; black, prothorax, elytra and feet testaceous ; antennæ brown, with first 2 joints pale ; prothorax wider than long, more narrowed behind ; sides scarcely sinuate near the base, hind angles obtuse, very slightly prominent ; basal impressions feeble, with a few punctures ; eyes smaller and less prominent than usual. New Jersey and Virginia, two specimens .... 16. nigriceps, n. sp.

3 mm. More elongate, black or piceous ; antennæ and feet testaceous ; the former sometimes brown, with two basal joints pale ; prothorax but little wider than long, narrowed behind ; sides scarcely sinuate near the base ; hind angles obtuse, slightly prominent ; basal impressions broad, sparsely punctured ; eyes large, prominent.. .... 17. tantillus.

3—3·25 mm. Same form and color as the last, from which it differs only by the sides of the prothorax being distinctly subsinuate behind the middle and the hind angles nearly rectangular, not rounded, and somewhat prominent ; the basal impressions are larger and more punctured ; eyes large and prominent ; antennæ brown, first two joints and feet testaceous.
18. californicus.

3·25 mm. Same form as the two preceding, but differing by the prothorax, the sides of which are obliquely rounded behind the middle, and the hind angles obtuse and rounded ; basal impressions less deep, sparsely punctured ; feet testaceous ; antennæ dark piceous ; first two joints testaceous.
19. neglectus.

b. Stria of elytra effaced, except the sutural one, which is deep ; body rather stout and convex ; prothorax not narrowed behind ; sides subsinuate behind the middle ; hind angles rectangular ; basal impressions very feeble.

4·5—6·5 mm. Varies from testaceous to greenish black with a bronzed reflection ; first two joints of antennæ and feet testaceous. Traces of a long scutellar stria are apparent in some specimens of this species, which thus differs from all the others in which the middle tarsi of the male are not furnished with papillæ............... .... 20. nitidus.

C.

This division contains but a single species of very elongate linear form, in which the eyes are much smaller and less prominent than in any other known to me ; the prothorax much longer than wide, somewhat narrowed behind, broadly sinuate on the sides, which have the lateral bead much more strongly marked than in the other species : the basal impressions are long, narrow, deep and punctured ; the hind angles rectangular ; the elytra at the base are wider than the prothorax, very long and parallel, obliquely sinuate and subtruncate at tip ; the striæ are deep, the scutellar is represented by a large puncture, and the second stria has a dorsal puncture behind the middle. The tibiæ are more spinous than in the other species, and the whole appearance of the insect is that of a small *Pterostichus*. The front tarsi of the male are feebly dilated, the middle tarsi without papillæ.

5·5 mm. Black, margins brownish ; antennæ brown ; first two joints and feet testaceous yellow ; prosternum channeled between the front coxæ ; peduncle of mesothorax coarsely punctured... .... 21. linearis.

Bibliography and Remarks.

1. B. dichrous *Lec.*, Trans. Am. Phil. Soc., x, 385; *Harpalus dichrous* Dej., Sp. Gen., iv, 258; *H. iricolor* Say, Trans. Am. Phil. Soc., iv, 432.

2. B. vulpeculus *Lec.*, Trans. Am. Phil. Soc., x, 385; *Harpalus vulp.* Say, Trans. Am. Phil. Soc., ii, 30, ed. Lec., ii, 458; ibid. iv, 432, ed. Lec., ii, 545.

3. B. autumnalis *Lec.*, Trans. Am. Phil. Soc., x, 385; *Feronia autumn.* Say, Trans. Am. Phil. Soc., ii, 48, ed. Lec., ii, 473; *Geobænus autumn.* Lec., Ann. Lyc., N. York, iv, 403.

4. B. badiipennis *Lec*, ibid., x, 385; *Stenolophus bad.* Hald., Proc. Acad. Nat. Sc., Phil., i, 302; *Geobænus ruficrus* Lec., Ann. Lyc., N. York, iv, 404; *Geobænus lugubris* Lec., ibid., iv, 405.

5. B. atrimedius *Lec.*, ibid., x, 385; *Feronia atr.* Say, Trans. Am. Phil. Soc., ii, 39, ed. Lec., ii, 466; *Trechus similis* Kirby, Faun. Bor. Am., iv, 48.

6. B. nebulosus *Lec.*, ibid., x, 385; *Acupalpus suturalis* || Lec., Ann. Lyc., N. York, iv, 411.

7. B. nigrinus *Motsch.*, Käfer Russl., 22; *Harpalus nigr.* Dej., Sp. Gen., iv, 399; Mannh. Bull. Mosc., 1843, 213, ibid., 1852, 298; *Geobænus quadricollis* Lec., Ann. Lyc., New York, iv, 405.

8. B. tibialis *Lec.*, List of Col. N. Am. 12; *Trechus tibialis* Kirby, Fauna Bor. Am., iv, 46; *Geobænus tib.* Lec., Ann. Lyc., N. York, iv, 405.

9. B. axillaris *Lec.*, List of Col. N. Am. 12; *Acupalpus ax.* Mannh., Bull. Mosc., 1853, 124. I received a specimen of this species from Count Mnisech, under the name *Ac. conflagratus* Mann., ibid., 126.

10. B. cognatus *Schiodte*, Danm. El., i, 158; ej. Naturhist. Bidrag. Grönland, 54; *Acupalpus cogn.* Dej., Sp. Gen., iv, 440; *Ac. longiusculus* Mannh., Bull. Mosc., 1853, 125; and *B. nitens* Lec., Proc. Acad. Nat. Sc., Phil., 1858, 60.

11. B. cordicollis *Geobænus cord.* Lec., Ann. Lyc., N. York, iv, 406.

This species has been accidentally omitted in my list of N. Am. Coleoptera.

12. B. congener *Lec.*, Melsh. Cat. Descr. Col., 25; *Geobœnus cong.* Lec., Ann. Lyc., N. York, iv, 407; *B. nubifer* Lec., Pr. Ac., 1858, 60, is a pale variety from Arizona, having the trunk and a small dorsal elytral cloud dusky. *B. ventralis* Lec., ibid., is a specimen with more numerous punctures at the base of the prothorax.

13. B. rupestris *Lec.*, Mels. Cat. Descr. Col., 25; *Trechus rupestr.* Say, Trans. Am. Phil. Soc., ii, 91, ed Lec., ii, 505; *Geobænus rup.* Lec., Ann. Lyc., N. York, iv, 406; *Acupalpus elongatulus* Dej., Sp. Gen., iv, 457; *Trechus flavipes* Kirby, Fauna Bor. Am., iv, 47; *Stenolophus cinctus* Say, Trans. Am. Phil. Soc., iv, 434, ed. Lec., ii, 547.

14. B. parallelus *Chaud.*, Rev. et Mag. Zool, 1868; ? *Acupalpus debilipes* Say, Trans. Am. Phil. Soc., iv, 425, ed. Lec., ii, 548.

15. B. rivalis *Lec.*, Proc. Acad. Nat. Sc., Phil., 1858, 60.

17. B. tantillus *Chaud.*, Rev. and Mag. Zool., 1868; *Acupalpus tant.* Dej., Sp. Gen., iv, 465.

18. B. californicus, *Stenolophus cal.* Lec., Pac. R. R. Expl., xi, 2, Ins., 29.

19. B. neglectus *Geobænus negl.* Lec., Ann. Lyc., N. York, iv, 407; *Stenolophus negl.* Lec., Trans. Am. Phil. Soc., x, 385.

20. B. nitidus *Mannh.*, Bull. Mosc., 1843, 214; *Acupalpus nit.* Dej.; Sp. Gen., iv, 474.

21. B. linearis *Lec.*, New Spec. Col. (Smiths. Inst.), 16.

Acupalpus symmetricus *Motsch.*, Bull. Mosc., 1859, 2, 134. I have not identified this species, but suspect it to be a Western race of B. rupestris.

Trechus immunis *Kirby*, Fauna Bor. Am., found in lat. 54°, I have not identified; it is perhaps Stenolophus carus *Lec.*, but the description is scarcely sufficient to warrant the placing of the latter in synonymy.

Geobænus arenarius *Lec.*, Ann. Lyc. Nat. Hist., New York, iv, 403, referred by me (Trans. Am. Phil. Soc., x, 385) to Bradycellus, is proved by the discovery of the ♂ to belong to Amara, division LIOCNEMIS.

The following reports were read and referred to the Publication Committee :

REPORT OF THE CURATORS.

Another year has passed with its usual addition of treasures to the Museum of the Academy, which has now become, from its exceedingly crowded condition, rather a rich store house of materials for the use of naturalists, than a convenient place of exhibition and study. A new and previously unforseen incident has occurred during the year which greatly contributes to the necessity of our seeking other quarters. A huge store, recently erected in the rear of our building, so much diminishes the light from that direction, as greatly to interfere with the view of objects in the museum.

The trustees of the building fund of the Academy continue their efforts to procure means to provide proper accommodations for the purposes of the institution, not only suitable to its present condition, but having in view its future increase, but their means are not equal to what are desirable. Having obtained subscriptions from citizens of upwards of $100,000, they have selected and purchased an ample piece of ground, in many respects well selected and located, at the south-west corner of 19th and Race Sts., opposite one of the finest public squares of the city. But the lot has cost upwards of $60.000, and the estimates of an appropriate building approach $300,000, which we see but little prospect of obtaining.

Many of the subscribers to the building fund and other citizens object to the location chosen, and consider that a position on Broad Street would be in many respects more desirable, and especially as it would there be more in the way of travel of those most interested in the institution. Admitting this view to be correct, a greater difficulty in the way of accommodating the Academy in this position, is the much greater value of the ground than in the locality already chosen.

Most of the members of the Academy, and numerous citizens hope and look for aid from our Legislature and City Councils, in the suggested appropriation of one of the Penn Squares for the uses of the institntion. Taking the view that the Academy is virtually a public institution, of which its members are the trustees, and considering the importance it is to the intellectual interests of the public, it appears to us no mor than a matter of justice that the city should be enabled to appropriate for the use of the Academy, what is now really a useless common. It is to be hoped that the efforts now being made by the Trustees of the Building Fund of the Academy, to obtain an act of the Legislature to permit our City Councils to appropriate one of the Penn Squares to our uses may prove successful. With such assistance, we could no doubt readily obtain the additional means to erect a suitable building for the Academy, one which, with its stores of intellectual treasures open free to the public, would become one of the most attractive features of Philadelphia.

The Museum collection is in good condition. Our thanks are due to Messrs. Isaac Burke and E. Dieffenbaugh, who have poisoned the entire American Herbarium, and are now engaged in doing the same with the General Herbarium. This is a most important work, ensuring the plants against the depredations of insects.

Among the most important and attractive additions made to the Museum during the year is the restored skeleton of the great extinct reptile Hadrosaurus, now occupying the fore part of the lower hall. The restoration is due to the accomplished natural history artist B. Waterhouse Hawkins, of London, and when we add that all the labor and expense attending the restoration was a voluntary contribution of the gentleman, we cannot too much express our gratitude to him.

The fine mounted specimen of the great extinct Elk, of Ireland, which has so long been a conspicuous object in the Museum, and which had been on deposit with the Academy, has now become its property, having been presented, together with other specimens of the same animal, by our fellow member, Mr. Joseph A. Wright.

In the month of December some thieves gained access to the Academy, and broke open several of the mineral cases, from which they abstracted a number of specimens, principally gold and precious gems. Fortunately most of the specimens have been recovered, and one of the thieves was apprehended and is now in prison.

During the year, notwithstanding the Academy was closed twelve of the usual visiting days, there were 65,769 visitors to the Museum.

The following is a synopsis of the donations made in the different departments of the Museum during the year.

Mammals.—Twenty-one species, besides two small collections, were presented by E. D. Cope, W. M. Gabb, H. Yarnal, I. I. Hayes and W. Raborg.

Birds.—Two small collections of birds and of nests and eggs, together with sixteen additional specimens, were presented by E. J. Lewis, E. D. Cope, W. S. Wood, J. D. Sergeant and C. S. Westcott.

Reptiles.—Prof. E. D. Cope presented a collection of 1465 specimens of 118 species from Pennsylvania, Virginia and Brazil; 40 species from Equador; four collections from Brazil, New Granada, Central America and elsewhere; and in addition, 33 species from Central America, the Rocky Mountains and elsewhere. Dr. George H. Horn presented a collection of 48 specimens of 16 species from Arizona and California; Dr. G. Lincecum, 104 specimens of 14 species of Texas; W. M. Gabb, 10 species from Lower California and Nevada; Ed. Day, a collection in 5 jars from Equador; and the Smithsonian Institution 20 species from Guayaquil, besides 8 species of Amblystoma. Others were presented by Dr. J. L. LeConte, Jos. A. Clay, C. B. Adams, C. Guillou, Dr. Randall and J. C. Brevoort.

Fishes.—Prof. Cope presented two collections in 30 jars from Kansas and New Granada, besides 23 species from the Potomac, the Wabash, New Jersey, and elsewhere. F. Sumichrast presented a collection of 86 specimens of six species from Mexico; Dr. Geo. Davidson, 15 species from Alaska; and Thomas Davidson, a collection from the West Indies.

Mollusks.—Many donations of mollusca have been made through the Conchological Department, for an account of which refer to the report of its Conservator.

In addition the Academy has received a large collection of unionidæ and other shells of the late Major LeConte, from Dr. John L. LeConte. Specimens were also received from J. R. Willis, W. M. Gabb, Dr. Genth and the Smithsonian Institution.

Articulates.—A collection of upwards of 600 species of exotic coleoptera, belonging to the late Dr. Zimmerman, was presented by Drs. John L. LeConte, Samuel Lewis, G. H. Horn, F. W. Lewis and Messrs. I. Lea, S. S. Haldeman and E. Draper. Dr. H. C. Wood presented 19 species of phalangidæ; J. R. Willis a small collection of crustacea, from Nova Scotia; and 14 species of myriapods, crustaceans, etc., were presented by W. M. Gabb, Geo. Davidson, J. L. LeConte, Edw. D. Cope, J. Lambert, H. Allen, and D. G. Brinton.

Radiates.—Nine echinoderms were presented by W. M. Gabb, Geo. Davidson and J. Adams.

Fossils.—Especially in the department of palæontology has the Museum of the Academy increased during the year. Besides the important addition mentioned in the introductory portion of the report, the following have been received.

A collection of about 3000 specimens of 500 species of fossils from the triassic, cretaceous, and tertiary formations of California, Nevada and Oregon, deposited by Wm. M. Gabb. Many of the species are types described by Mr. Gabb.

A part of the Poirrier collection of remains of mammals, birds, and fishes from the miocene, pliocene and post-pliocene formations of the valley of the Loire, France, purchased at a cost of $700, and presented by Messrs. Samuel and John Welsh, Isaac Lea, W. S. Vaux, and John Rice.

The greater part of the skeleton of an enormous extinct saurian, described by Prof. Cope, under the name of Elasmosaurus platyurus, from near Fort Wallace, Kansas, presented by Dr. Theop. H. Turner.

Two collections consisting of upwards of 1000 specimens of about 40 species of teeth of sharks and other fishes, and many specimens of 16 species of cetaceans, from the miocene formation of Charles Co., Maryland, presented by Prof. Edward D. Cope.

A collection of remains of Lælaps and other extinct reptiles from the marls of New Jersey, presented by Prof. Cope.

A collection of tertiary and cretaceous plants from Colorado, New Mexico, and Kansas, described by Lesquereux, presented by Dr. John L. Leconte.

L. P. Wheelock presented 58 fossils of the corniferous limestone of Ohio; Col. James Greer, 33 fossils from Ohio; and Rev. E. B. Eddy 17 fossils from Iowa.

Small collections from Ohio, Virginia, Pennsylvania, Maryland and Nova Scotia and elsewhere, were presented by E. D. Cope, Dr. O. A. Judson, W. M. Gabb, John R. Willis, F. A. Randall, and Dr. J. T. Rothrock. Sixty additional specimens were presented by E. D. Cope, W. M. Gabb, Dr. F. A. Hassler, J. Leidy, E. R. Beadle, Dr. F. V. Hayden, Dr. J. L. LeConte, C. W. Matthews, Gen. John Gibbon, R. H. Lamborn, Dr. N. R. Bradner, John Walton, W. Köhler, G. W. Hall, H. R. Parker and C. W. Peale.

Minerals.—Small collections were received from John R. Willis and C. Guillon, and 40 specimens were presented by Dr. F. A. Hassler, T. D. Rand, W. S. Vaux, E. Draper, T. Guilford Smith, F. Lavergne, B. S. Lyman, E. R. Beadle, S. Tyson, Dr. J. Corse, Mr. Struthers, M. Phillips, T. F. Moss, F. V. Hayden, P. A. Snell, G. J. Ulex, B. A. Hoopes, Mr. Goldsmith and J. H. Claghorn.

Botany.—A collection of California plants were presented by Dr. W. P. Gibbons; 53 plants of New Jersey and Pennsylvania were presented by J. Burke and E. Diffenbaugh; and Dr. George Engelmann, of St. Louis, presented a copy of his Herbarium of the North American Junci.

Comparative Anatomy.—Dr. George Davidson presented skeletons of a male and female Otter, from Alaska. Dr. James L. Corse, presented a collection consisting of jars of embryo mammals, specimens for the microscope, entozoa, 7 human skulls, casts of 4, and the skeleton of an eagle. 23 skeletons, skulls and other specimens were presented by W. Bartram Snyder, I. I. Hayes, Joseph Jeanes, W. S. Vaux, Edward Cope, Wm. M. Gabb, O. N. Bryan, Prof. Von Siebold, of Munich, Edw. Davis, Dr Genth, I. Lea, and E. J. Lewis.

Miscellaneous.—Specimens were presented by Joseph Henry Craven, Rev. A. Grout, J. R. Willis, Wm. M. Gabb, J. B. Ellis, E. Borda, G. H. Horn, Dr. J. A. McConnel, P. Crosby, S. Powell, Rev. W. E. Hunt, and the United States Sanitary Commission.

Respectfully submitted by JOSEPH LEIDY,
Chairman of the Curators.

LIBRARIAN'S REPORT.

The Librarian respectfully reports that the number of additions to the Library from January to December, 1868, inclusive, amounts to 1323.

Of these there were volumes, 257; pamphlets, 1055; maps, &c., 11: Total, 1323. 33 were folios; 323 quartos; 952 octavos; 4 duodecimos, and 11 maps.

These were derived from the following sources:

Editors, 159; Authors, 111; Societies, 636; Library Fund, 246; Wilson Fund, 105; Minister Public Works, France, 9; Messrs. Townsend & Adams, 8; Publishers, 8; Geol. Survey of Sweden, 4; Geol. Survey of India, 5; Geol. Survey of United Kingdom, 3; Treasury Department, 7; Navy Department, 1; B. Westermann & Co. 1; Wm. M. Gabb, 3; Jos. Jeanes,1; Surgeon General, 1; Smithsonian Inst., 2; Dr. F. A. Hassler, 2; J. D. Sergeant, 4; Land Office, 1; S. S. Haldeman, 1; Wm. Warren, 1.

And were divided as follows:

Journals, 971; Geology, 80; General Natural History, 56; Entomology, 39; Botany, 28; Conchology, 24; Anatomy, 20; Physical Science, 17; Ornithology, 17; Voyages and Travels, 15; Bibliography, 9; Ichthyology, 9; Mammalogy, 6; Herpetology, 6; History, 8; Helminthology, 3, Mineralogy, 3; Chemistry, 1: Medicine, 1.

In addition to the above, eleven volumes and 113 pamphlets were presented through the Conchological section, making the entire increase 268 volumes and 1179 pamphlets, maps, charts, &c.

The total number of volumes now in the library is 21,964.

During the year 79 volumes have been bound, and 60 additional volumes are now in the hands of the binder.

For expenses of binding, amounts paid for books, salaries, &c., reference is made to the report of the Treasurer of the Academy.

To the list of missing books must be added the first volume of Hewitson's Exotic Butterflies, Bois-Duval and LeConte's Lepidoptera of North America, and Darwin's Journal of Researches in the Beagle, edition of 1845. Although search and inquiry have been made for these works, no information regarding their whereabouts has as yet been obtained. The loss of the first named is particularly unfortunate, as it breaks the suite of a valuable illustrated work, each volume of which is worth about $25.00 in gold.

The Conchological department is so comparatively complete in itself that it is proposed as an experiment to number the works contained therein, with a view to extending the arrangement to the general library, if, after sufficient experience, it be found to be as beneficial as is anticipated. There is little doubt that the numbering of the books consecutively on the shelves and in the catalogues will greatly facilitate reference, while it will, it is hoped, tend to prevent misplacements and losses.

Owing to the very small amount of funds annually at the disposal of the Library Committee, but more especially during the past year, the number of books purchased for the use of the working members of the Academy has been entirely inadequate to their wants. The botanical and geological libraries are particularly deficient in the more important works recently published. These are mentioned especially, not because they stand alone in their imperfect condition, but because being most constantly referred to, they should receive the more immediate attention.

Three hundred dollars are annually received from the Wilson legacy, but, far from supplying the wants of the library, this amount is not sufficient to pay for the continuations of the works subscribed for by Dr. Wilson himself, and it has been necessary for the last two years to make up the deficiency from another source. Nor will the sum of $1000.00, lately appropriated by the Academy, suffice to remedy the evil but for a very short time. This will be readily believed when it is known that the publication price of one work alone, which is required immediately, is $320.00 in gold.

The Library Fund, by means of which many valuable works have been obtained, was exhausted during the past year, so that in the *immediate* future, at all events, no such source of supply will be at hand.

Under these circumstances the propriety of selling certain books in our possession, which have no direct connection with the Natural Sciences, has been suggested. Some years since a large and valuable collection of French Historical Documents, given to the Academy by Wm. Maclure, was thus disposed of greatly to the advantage of the library.

The opinion is now entertained by some of the members of the Academy, that a similar disposition with similarly good results might be made of the collection of works on Antiquities and the Fine Arts now in our possession. This collection embraces some rare and valuable works which are practically worthless to the Academy. If sold to an institution or individual interested in the subjects treated by them, their usefulness would be greatly increased, while means would be provided for obtaining those works which are of the utmost importance to all those engaged in the study of the natural sciences.

All of which is respectfully submitted.

Edw. J. Nolan,
Librarian.

REPORT OF THE RECORDING SECRETARY.

The Recording Secretary would beg leave to report,—

That during the year ending November 30th, 1868, there have been elected sixty-five members and twenty-one correspondents.

The death of the following members and correspondents have been announced.

Nine members, namely: Edw. B. Grubb, Tobias Wagner, Gen. Geo. A. McCall, Mr. Thomas Earp, Mr. C. F. Hagedorn, Mr. Isaac Barton, Mr. Matthew Newkirk, Mr. Jacob Gilliams.

Four Correspondents, namely: Rev. Mr. E. Johnson, Marcel de Serres, Sir David Brewster, Mr. Clot Bey.

The number of papers contributed and ordered to be printed in the Proceedings and Journal during the year has been forty-nine, as follows:

In the Proceedings thirty-six, namely:

E. D. Cope	12	Isaac Lea	8
John Cassin	1	Thomas Meehan	5
Jacob Ennis	1	T. D Rand	1
George N. Lawrence	1	W. B. Butcher, M.D	1
Elliot Coues, M.D	2	Alphonso Wood	1
Tryon Reakirt	1	Joseph Leidy	11
Thaddeus Norris	1		

In the Journal three, namely:

Isaac Lea, 1; Joseph Leidy, 1; E. D. Cope, 1.

All of which is respectfully submitted.

S. B. Howell,
Rec. Sec'y.

REPORT OF THE COMMITTEE ON HERPTOLOGY AND ICHTHYOLOGY.

The Committee on Herpetology and Ichthyology respectfully reports:

That there has been added to that part of the Museum under its care the following collections of Reptiles in Alcohol.

Duplicates of the collections made for the Smithsonian Institution in Vera Cruz, Mexico, by Francis Sumichrast, which are very extensive; the same of collections made for the same in high Guatemala, by Henry Hague; same of collections made in Yucatan, Belize and Tabasco, by Schott, Parsons and Berendt; with other duplicates of collections from Central America. Duplicates of collections made in Venezuela, and at Guayaquil, by Messrs. Destruges and Reeve. Duplicates also from the Smithsonian Institution from collections made in San Domingo, by W. Younglove; in Navassa, by W. Raisin; and in Porto Rico, by Geo. Latimer; from San Francisco, Cal., and from Vancouver's Island, made by A. W. Hewson. Also similar series from Arizona, collected by Elliott Coues, M.D., and from Camp Grant in the same Territory made by Dr. Canfield.

In the same manner the Committee has received duplicates of the collections of the Essex Institute, from Madagascar, Zanzibar and Western Africa.

There have been procured by exchange the large collections made by the Orton Expedition to Equador and the Upper Amazon; also collections from the Cape of Good Hope, the Seychelle Islands, and from Surinam by exchange with the Historical Society of Long Island.

By presentation the Committee has obtained a fine collection from Beyrut, Syria, which also embraced mammals and other objects; similar collections from Bahia, Brazil; one from Central America, and two from unusual localities in New Grenada. Collections also from California and Lower California, and from Owen's Valley on the boundaries of Nevada. Also smaller collections from Australia, Africa, Persia and other places in Asia.

Of fishes there have been also numerous additions made to the charge of the Committee. They have not received much in this department by the duplicates of other museums, but have been chiefly dependent on presentation. In this way we have acquired large series of species from the Island of St. Kitts, West Indies, from St. Croix, West Indies, and from the Coasts of Alaska. Also from the rivers of South Western Virginia; from the Alleghany River above Pittsburg; from the branches of the Missouri River near Leavenworth, Kas., and from the Miami River, Ohio. All these are collections of considerable extent.

Smaller collections have been procured from Surinam, Central America, and Mexico; also from Beyrut, Syria, and from Newport, Rhode Island.

The above collections, embracing a great number of specimens, were sorted, bottled, labelled, and classified in the Museum by the Museum Assistant, thus saving a great deal of time to the Committee, and enabling them to pursue scientific investigations on such and other material.

The Committee also congratulates itself on the benefits accruing to the committee's department, through the employment by the Curators of a French preparateur. Exclusive of numerous preparations in the department of birds and mammals, the committee have now a series of skeletons of forty species of Reptiles, and eighty of Fishes, obtained at rates far lower than by any other means known to the Committee. At the same time the Museum Assistant has received instruction in preparing skeletons and skins, thus supplying a want which the Committees department and several other departments have experienced for several years past.

Which is respectfully submitted by

EDWARD D. COPE, *Chairman.*
ROBERT BRIDGES.

REPORTS OF THE CONCHOLOGICAL SECTION.

RECORDER'S REPORT.

During the year ending Dec. 3, 1868, there have been elected two members and four correspondents.

The death of one correspondent, Rev. E. Johnson, of Waioli, S. I., was announced Nov. 5, 1868.

Thirty-five papers have been accepted for publication in the Journal, by the following authors:

Prof. O. A. L. Mörch,	1	Geo. W. Tryon, Jr.,	8
Wm. M. Gabb,	7	Dr. James Lewis,	5
Wm. Harper Pease,	3	T. A. Conrad,	4
Dr. J. G. Cooper,	2	S. R. Roberts,	2
Prof. S. S. Haldeman,	1	Thomas Bland,	1
Dr. P. P. Carpenter,	1		

The following amendment to the By-Laws was adopted, adding to Art. X of Chap. XII the words "or of the Academy;" so as to read: "The actual date of publication of any issue of the 'Journal' shall be determined by the published record of its presentation at a meeting of the Section or of the Academy."

Respectfully submitted,

S. R. Roberts, *Recorder.*

List of Members elected during 1868.—Mrs. Lucy W. Say, Dr. F. A. Hassler.

Correspondents.—G. B. Sowerby (elected in 1867), London; *Rev. E. Johnson*, Waioli, S. I. (deceased); Col. E. Jewett, Utica, N. Y.; Dr. Ferd. Stoliczka, Calcutta; Ralph Tate, London.

REPORT OF THE SECRETARY.

To the Conchological Section of the Academy of Natural Sciences, Philadelphia:

The Secretary would respectfully report that letters have been received as follows, since the last annual meeting, viz.:

Dec. 31, 1867.—Alpheus Hyatt, Salem, Mass., in acknowledgement of election as correspondent.

Feb. 4*th*, 1868.—Dr. O. A. L. Mörch, Copenhagen, acknowledgement of election.

Feb. 4*th*, 1868.—Jabez Hogg, London, with publications forwarded.

April 20*th*, 1868.—Robt. Dinwiddie, New York. Letter of thanks.

May 10*th*.—G. Nevill, Calcutta. Offering an exchange of specimens.

May 15*th*.—Prof. S. L. Abbott, Boston. Letter of thanks.

May 26*th*.—Prof. Jos. Henry, Smithsonian. Letter of acknowledgement.

June 13*th*.—Prof. S. F. Baird, S. I. Letter of thanks.

July 17*th*.—Dr. O. A. L. Mörch, Copenhagen. Letter of thanks.

Oct. 10*th*.—Dr. Ferd. Krauss, Stuttgardt. Letter of thanks.

Letters have been written as follows, viz.:

April 3*d*.—To Edmund Draper, Thomas Sparks, and G. W. Fahnestock, of Philadelphia, tendering the thanks of the Section for subscriptions towards the purchase of specimens.

To Geo. Davidson, Germantown, for a fine suite of shells from Alaska.

August 17*th*.—To Jabez Hogg, London, requesting an exchange of publications.

To G. Nevill, Calcutta, accepting proposals for an exchange.

Nov. 2*d*.—To Dr. E. Von Martens, Berlin.

To M. F. de Malgive, Bruxelles.

To Capt. J. Mitchell, Madras.

To M. Tasle, Pere, Varennes, France.

To Baron de Castello de Paiva, Lisbon.

To M. L. de Folin, Havre.

To M. Jules Chiron, Paris.

To Dr. Leopold Von Schenck, St. Petersburg, desiring an exchange of publications.

All of which is respectfully submitted.

E. R. Beadle, *Sec'y.*

Dec. 3*d*, 1868.

CONSERVATOR'S REPORT.

The Conservator of the Conchological Section respectfully reports that the following donations to the Cabinet have been received during the year:

Six hundred and sixty species of shells, principally from the collection of the late Hugh Cuming and for the greater part new to the museum, were presented, as follows: 267 species by Jos. Jeanes, 86 by Geo. W. Tryon, Jr., 46 by Thos. Sparks, 55 by Edm. Draper, 30 by C. F. Parker, 88 by Rev. E. R. Beadle, 45 by Isaac Lea, and by Wm. S. Vaux 42 species and a valuable specimen of *Cypræa umbilicata*.

From Dr. Jas. Lewis, seven species of fresh-water shells from the vicinity of Mohawk, N. Y.; also specimens of *Melantho decisa*, Say; *M. rufa*, Hald., and *M. integra*, Say.

S. R. Roberts. A suite of specimens of *Anodonta fluviatilis*, Soland., from Gray's Ferry, Philadelphia. Deformed specimens of *Anodonta implicata*, from Thorp's Dam, Philadelphia.

Wm. M. Gabb. About 3200 species, numerous specimens of marine, fluviatile and terrestrial shells.

Geo. W. Tryon, Jr. Fifteen species of *Pupa* and *Vertigo*, and two specimens of *Bulimus Jaurassii*,

John Cassin. Six species from Natal.

J. R. Willis. Two specimens of *Pecten islandicus* from Nova Scotia.

E. R. Beadle. Fifty-five species of marine, fluviatile and terrestrial shells.

E. Hall. Fifteen species.

W. H. Pease. Four hundred and ninety-six species of Australasian shells, principally marine.

Spiridione Brusina. One hundred and ninety-nine species from the Adriatic Sea.

Edw. D. Cope. Six species of land shells from Western Virginia.

Wm. G. Binney. *Helix Cooperi*, a unique specimen of an undescribed Helicina, and jaw of *Cylindrella trinitaria*.

Geo. Davidson. Sixty-six species, numerous specimens of Alaskan shells.

Isaac Lea. *Unio ligamentinus*, Lam.; *U. Tappanianus*, eight species of *Unio* from North Carolina and Georgia; *Eurycælon crassa*, Hald., *Amnicola Downiei* and three species of California fresh-water shells.

M. McDonald. Many specimens of *Helix bucculenta* from Lexington, Va.

H. Crosse. Eighty species, principally marine shells, from New Caledonia and the Adriatic Sea, and terrestrial shells from Dalmatia.

J. G. Cooper, M.D. Numerous specimens of California fluviatile and terrestrial shells.

Prof. O. A. L. Mörch. Seven species of fresh-water and land shells from Greenland.

F. V. Hayden, M.D. Nineteen species from Nebraska.

Geo. H. Horn, M.D. *Pisidium insigne*, Gabb, *Pupa Arizonensis*, *P. hordacea*, *Helix Horni*.

Smithsonian Institution. *Unio pliciferus*, Lea, *U. umbrosus*, Lea.

F. A. Genth. *Unio merus*, Lea, *U. Uhareensis*, Lea, and *Clausilia Braunii*, Charp.

F. F. Cavada. Nine species of shells from Cuba.

John Gregory. One species of *Cypræa* and one of *Cassidaria*.

Jos. Leidy. Four species from Lake Superior, and two species of Limniadæ from Wyoming Territory; *Planorbis trivolvis* and *Amnicola crassa*.

J. A. McConnell. Pearls from Unios from Little Miami River, Warren Co., O.

John Ford. Animal of *Pyrula canaliculata*.

R. E C. Stearns. Very fine specimens of forty species of west-coast shells.

Dr. John L. LeConte. One hundred and thirty-four species of Unionidæ, being the collection of the late Major John LeConte.

J. Van A. Carter. Four species from Dakota and Wyoming Territory.

T. N. Dale. Specimens of *Anomia epphipium*.

In presenting this list of the year's donations to the Conchological cabinet, amounting in the aggregate to about 6000 species, your special attention is called to the fine collection of upwards of 3000 species of marine, fluviatile and terrestrial shells presented by Mr. Wm. M. Gabb. This collection is particularly rich in west-coast species, and supplies a very large number of desiderata to our museum The number of rare and interesting species in our possession has also been greatly augmented by the addition of the shells purchased by subscription from G. B. Sowerby, the greater part of which belonged to the collection of the late Hugh Cuming; by nearly 500 species of Australasian shells received from Mr. Wm. Harper Pease, of Honolulu; by the unique collection of Alaskan shells presented by Geo. Davidson, and by many rare and valuable species of Unionidæ contained in the LeConte collection.

Shells have been sent during the year in exchange to Dr A. Brot, of Geneva, A. P. Terver, of Lyons, and W. Harper Pease, of Honolulu. For farther information regarding our foreign relations reference is made to the reports of the Corresponding Secretary and the Publication Committee.

Catalogues of all the families from Pholadidæ to Tellinidæ, inclusive, having been completed and published during the year, it is the intention of the Section to commence immediately the systematic arrangement of the Conchological collection. A number of members having volunteered to assist, the shells will now be cleaned, labelled and arranged as rapidly as circumstances will permit.

The Conservator has in his possession a photographic album containing sixty-one portraits of members of the Section and of distinguished Conchologists throughout the world. It is hoped that no opportunity will be neglected of soliciting contributions to this interesting collection from our correspondents.

In conclusion, the Conservator would congratulate the members of the Section that, from the successful operations of the past year, they have so much reason to draw encouragement for the future.

Respectfully submitted by

Edw. J. Nolan, *Conservator.*

LIBRARIAN'S REPORT.

The Librarian respectfully reports that there have been presented during the past year to the library of the Conchological Section, 11 volumes and 113 pamphlets. Of these 58 were received from authors, 31 from editors, 15 from Societies, 7 from the Publication Committee, 4 from Geo. W. Tryon, Jr., 4 from John Cassin, 4 from H. Crosse and 1 from Wm. M. Gabb.

In addition, twenty-seven pamphlets and continuations of Conchological works have been received by the Academy.

In consideration of the comparative completeness of the Conchological Library, the Librarian proposes, with the sanction of the Library Committee, to number the works in this department at as early a date as possible. It is hoped that this plan will facilitate the work of those wishing to refer to the books, while it lessens the chances of volumes being lost or misplaced.

Edward J. Nolan, *Librarian.*

The election of Officers for the ensuing year was held in accordance with the By-Laws, with the following result:

President	Isaac Hays, M. D.
Vice-Presidents	Wm. S. Vaux, John Cassin.
Corresponding Secretary	Edw. D. Cope.
Recording Secretary	S. B. Howell, M. D.
Librarian	Edw. J. Nolan, M. D.
Treasurer	Wm. C. Henszey.
Curators	Jos. Leidy, M. D. Wm. S. Vaux, John Cassin, Edw. D. Cope,
Auditors	Jos. Jeanes, Wm. S. Vaux, Aubrey H. Smith.
Publication Committee	Jos. Leidy, M. D., Robt. Bridges, M. D., John Cassin, Wm. S. Vaux, Edw. J. Nolan, M. D.

The following gentlemen were elected members:

Albert Peale, Franklin Platt, Jr., Edw. A. Spooner, M. D.

The following were elected correspondents:

Geo. Neville, of Calcutta, E. I., and Rev. Dr. Jos. F. Berg, of Rutger's College, N. J.

ELECTIONS FOR 1868.

The following persons were elected Members :

Jan. 28.—Edward Goldsmith, Joseph F. Sinnott, Rufus Bucknell.

Feb. 25.—C. Newlin Peirce, D.D.S., Stephen Morris, Thos. T. Tasker, Jr., Stephen P. M. Morris, Henry G. Morris, Jas. E. Caldwell.

March 31.—Richard Peltz.

April 28.—H. C. Chapman, M.D., Charles Wilson Peale, Benj. Bullock, Thomas Webster, Dr. E. Dyer.

May 26.—Edward Lewis, Jas. Freeman, M.D., Wm. Freeman, M.D., S. Fisher Corlies, T. W. Starr, Edwin Rhoades, M.D., T. H. Andrews, M.D., Herbert Morris, M.D., Jas. S. Gilliams, Charles Bullock, Edward L. Huitt, Joseph Zentmayer, August F. Müller, F. F. Maury, M.D., Horace Williams, M.D., W. L. McFadden, Wm. H. Walmsley, Robert W. Hargadine, M.D., T. L. Buckingham.

June 30.—Gilbert Combs, L. S. Bolles, M.D., J. F. Hollt, M.D., Isaac Comly, M.D., Francis P. Steel, Dr. Wm. Thomson, Rodger Sherman, John E. Carter, Wharton Barter.

July 28.—George Roberts, M.D., Levi Taylor.

Aug. 25.—B. Waterhouse Hawkins, Uselma C. Smith.

Sep. 29.—D. G. Brinton, M.D.

Oct. 27.—Philip S. Wales, M.D.

Nov. 24.—W. Mitchell McAllister, Emil Fischer, M.D. Isaac C. Price, Joseph G. Richardson, M.D., Wm. M. Darlington.

Dec. 29.—Albert Peale, Edwin A. Spooner, M.D., Franklin Platt, Jr.

The following were elected Correspondents :

March 31.—Major Geo. Clendon, Jr., Glenns Falls, N. Y. ; Dr. Fred. Stoliczka, Calcutta ; R. H. Stretch, San Francisco, Cal.

April 28.—Dr. Theophilus H. Turner, U.S.A. ; Augustus Fendler, Allentown, Md.

May 26.—A. R. Roesler, Washington, D. C. ; Hon. J. S. Wilson, Washington, D.C. ; John Tomes, F.R.S., London.

June 30.—Dr. John F. Boynton, New York City, N. Y. ; Prof. James Orton, Rochester, N. Y.

July 28.—Wm. T. Bingham, Boston, Mass ; Alponse Milne Edwards, Paris, France ; Rev. Sam. Haughton, Dublin, Ireland ; W. Kitchen Parker, F.R.S., London; T. Spencer Cobbott, M. D. ; London.

Aug. 25.—Ralph Tate, Lon. Eng. ; Prof. Oliver Wendell Holmes, Boston.

Oct. 27.—A. A. Breneman, Lancaster Co., Penn. ; Dr. L. E. Latimer, N. Y. ; Dr. H. Evan Rijgersma, St. Mortins, W. I.

Nov. 24.—Prof. H. James Clark, Centre Co., Pa.

Dec. 29.—Geo. Neville, Calcutta, E. I. ; Rev. Dr. Jos. F. Berg, Rutgers College, N. J.

CORRESPONDENCE OF THE ACADEMY,

For 1868.

January.—La Société Hollandaise des Sciences, announcing that they have forwarded the Archives Neerlandaise, t. i, 3, 4, 5.

K. K. Zoologisch-botanische Gesellschaft, Wein, acknowledging receipt of Proceedings.

Geological Museum, Calcutta, with their publications for the Library.

Nassauischen Vereins für Naturkunde, Weisbaden, acknowledging receipt of Proceedings and sending publications in return.

Der Naturforschende Verein zu Riga, acknowledging receipt of Proceedings and with publications sent in return.

Geo. W. Davidson, Edinburg, Scotland.

Harrison Allen, resignation of office, Corresponding Secretary.

Real Observatoire de Madrid, with donations for Library.

February.—American Entomological Society ;

Der Naturwissenschaftliche Verein Lüneburg ;

Naturforschenden Gesellschaft, Berlin, severally acknowledging receipt of Proceedings.

Université Catholique de Louvaine, acknowledging receipt of publications of the Academy, and sending the publications of the University in return.

Die Naturhistoriche Verein, Hanover, with publications.

Geo. Davidson, U. S. Coast Survey.

Gesellschaft der Wissenschaften zu Göttingen, with publications.

Thomas A. Scott, Phila.

B. Dyer, S. Abington, Mass.

D. E. Macpherson, conveying information of the death of Sir David Brewster, Feb. 10, 1868.

From Neuwied, conveying information of the death of Prinzen Maximillian zu Wied.

March.—Geological Museum, of Calcutta, India ;

Museum at Bergen, Norway ;

Essex Institute and Die naturforschende Gesellschaft. severally acknowledging receipt of Proceedings.

Universitatis Carolinæ Lundensis Rector.

Prof. Joseph Henry, Smithsonian Institution.

Chicago Academy of Natural Sciences, with transactions.

Canadian Sec. of State, with Report of the Progress of Canadian Geological Survey, from 1863 to 1866.

K. K. Zool. botan., Gessellschaft, with donations to the Library.

Edward L. Berthoud, Golden City, Colorado, acknowledging receipt of diploma.

April.—Rector de la Universidad de Chilé.

L. S. Ward, Treas. Foreign Missions, New York.

H. H. Jessup, Montrose, Pa.

R. Odinet, Agent of Havre, Boston and Philadelphia Steamship Company.

E. B. Cary, Ann Arbor, Mich.

G. Schwartz, Vienna, acknowledging election as correspondent.

H. B. Wetzell, Phila.

Samuel Jeanes, resignation of membership.

Naturkunde Gesellschaft in Württemburg, acknowledging receipt of Proceedings.

Naturwissenschaftliche Verein zu Bremen ;

Académie Royale de Belgique ;

Akademie der Wissenschaften, severally sending publications.

May.—Prof. Joseph Henry.

J. S. Wilson, Geological Museum, Gen. Land Office.

J. F. Williams, Sec. Minnesota Hist. Society.

Boston Society of Nat. History, acknowledging receipt of Proceedings and Journal and accompanied by publications in return.

Zoolog. Museum in Vienna, asking that deficiencies in Academy publications may be supplied.

M. Sumichrast Orizaba.

Jas. M. Fisher, Pittsburg, Pa.

S. A. Briggs, Chicago, Ill.

William Pepper, M. D., Phila.

Jas. Orton, Rochester, N. Y.

June.—John Henry Gurney, Devonshire, acknowledging election as Corresponding member.

A. Ten Brock, Librarian of the University of Michigan;

Warren & Co., Liverpool Steamship Office;

Antonio de Lecerda, Bahia;

Alexander Schyanoff, Kiew;

Lyceum of Natural Hist. of New York, each acknowledging receipt of Proceedings.

Naturforschende Gesellschaft in Dantzig, acknowledging receipts of Proceedings, and presenting publications in return.

La Fondation Teyler à Harlem, presenting publication.

July.—Wharton Barker, acknowledging election.

Essex Institute, acknowledging receipt of Proceedings.

Prof. Joseph Henry, Smithsonian Inst

A. R. Roessler, Washington, Gen. Land Office.

G. W. Coan, Oroomiah, Persia.

Franz Baumgartner, announcing the death of Andreas Freiherrn von Baumgartner.

Real Observatoire de Madrid, with donation for Library.

August.—Royal Geog. Soc. London, sending 37th vol. of Journal.

D. G. Brinton, acknowledging election.

Académie Royale de Belgique, acknowledging receipt of Proceedings.

Nat. Hist. Society of Northumberland, announcing the sending of Nat. Hist. Transactions, and asking for papers in return.

Hungarian Academy of Science, acknowledging receipt of Proceedings and presenting books to the Library.

British Museum;

Geological Society of London, each acknowledging receipt of Proceedings and Journal.

Linnean Society acknowledging receipts of Jour. and Proceed.

Prof. Joseph Henry.

Edward C. H. Day, Scarsdale, N. Y.

James Orton, Rochester, N. Y.

Dr. G. Radly, Tiflis.

T. H. Turner, Fort Wallace, Kansas.

Alexander Clot Bey, announcing the death of Monsieur Antoine Barthélemy Clot Bey.

September.—Leeds Philosophical and Literary Society;

Naturforschende Verein in Brünn;

Natural Hist. Society of Northumberland, each acknowledging receipt of Proceedings.

American Pharmaceutical Association, acknowledging receipt of invitation to visit Museum of the Academy.

W. W. Keen, M. D., Phila.

J. A. Allen, Springfield, Mass.

James Orton, Rochester, N. Y.

October.—Smithsonian Institution, acknowledging receipt of Proceedings.

Essex Institute, acknowledging receipt of Proceedings.

E. C. Bolles, asking for copies of Journal.
Jas. Orton.
Mahlon Carver.
John S. Hart, of Trenton Normal School, asking privilege of using the Museum.
Prof. C. Root, of Hamilton College, acknowledging election.

November.—Jas. D. Dana.
A. R. Roessler, Gen. Land Office.
Thomas Barnett, with casts for the Museum.
Augustus Fendler, acknowledging election.
John Akhurst.

December.—Die Gesellschaft der Wissenschaften, acknowledging receipt of Proceedings and presenting publications.
Schweizerische Gesellschaft and Naturforschende Gesellschaft, each acknowledging receipt of Proceedings and presenting publications in return.
Die Senckenbergische Naturforschende Gesellschaft, presenting publications.
Wm. T. Brigham, Boston.
Prof. O. W. Holmes, Boston.

Whole number of letters received 98.

DONATIONS TO THE MUSEUM.

1868.

(For donations to Conchological cabinet, see Report of Conservator of Conchological Section.)

Adams, C. B. *May 5th.* Celestus impressus, Jamaica.
Adams, J. *July 7th.* Coral.
Allen, Dr. H. *July 7th.* Astacus from Ockoganey River.
Beadle, Rev. E R. *Nov. 3d.* Gigantic crystal of Felspar from Newcastle Co., Del.; eight specimens of Numulitic limestone from Northern Syria; block of permian limestone from Junction City.
Borda, E. *March 10th.* Specimen of fruit.
Bourquin, F. *July 7th.* Dryopterus, Polypodium.
Bradner, Dr. N. Roe. *Dec. 1st.* Large specimen of Shell Rock from the reefs of Florida.
Brevoort, J. C. *Nov. 3d.* Loxopholis rugiceps, Cope, from New Grenada.
Brinton, Dr. D. G. *Nov. 3d.* Queen Termite from Cape Palmas, Africa.
Bryan, O. N. *May 5th.* Skulls of two species of Lepidosteus.
Burk, I. and E. Diffenbach. *Jan. 21st.* A collection of 53 plants of Pennsylvania and New Jersey.
Claghorn, Jas. H. *Nov. 3d.* Stalactite from Cave of Addelsburg, Austria.
Clay, Jos. A. *Jan. 21st.* A serpent from Peru.
Cope, E. D. *Jan. 7th.* One reptile from Brazil, 45 specimens, 9 species of fishes from Conestoga River; 164 specimens, 15 species from Roanoke River; 151 specimens, 34 species from James River, Va.; 644 specimens, 26 species from Kanawha River, Va.; 460 specimens, 33 species from Holston River. *Jan. 14th.* A collection of upwards of 1000 specimens, 40 species of teeth of sharks and other fishes from the miocene of Charles Co., Md. *Jan. 21st.* Five species of fishes from Potomac River, 10 species from Wabash River, and 9 species of reptiles from Rocky Mountains. *Feb. 4th.* Seven species of skins of fishes, many specimens from Brown's Mills, N. J.; small collection of subcarboniferous fossils from west side of Saltville, and from Walker's Mt., Smith Co., Va.; small collection of

coal plants and specimens of coal from carboniferous formation of Richmond, Va.; skins of Arvicola pinetorum, A. Pennsylvanica, Scalops Canadensis, Jaculus Hudsonius and Blarina Carolinensis, from Charles Co., Md. *March 3d.* Eighteen species of Reptiles, one Crustacean, one Insect, from Central America. *March 10th.* Large serpent from Vera Paz, C. A., and a small collection of mammals and birds in alcohol from Giles Co., Va. *May 5th.* Specimens of Neotoma Floridana, Austinville, Wythe Co., Va.; Heterodon from Saltville, Va.; Celestus striatus, Jamaica; and a snake from Central America. *May 19th.* Nineteen jars of fishes, from Kansas; skull of Globiocephalus melas, from New Jersey. *June 2d.* A collection of fossil Unionidæ, from the green sand of New Jersey; numerous remains of Lelaps aquilungus, from the green sand of Barnsboro', Gloucester Co., N. J.; femur of Hadrosaurus Foulkii, from the same locality. *June 23d.* Megaptera pusilla, Cope, from the miocene, Charles Co., Md.; Ixacanthus velox, Cope, from same locality. *July 7th.* Skeleton of Aspidonectes spinifer, from Alleghany River, Pa.; a Skate from Syria. *July 21st.* Five mammal skins; a red squirrel; Jacare punctatula; twenty-two jars of reptiles, fishes, &c., from Magdalena River, New Grenada. *Sept. 1st.* A collection of mammals and reptiles in ten jars, from Bahia, Brazil; six bird skins from St. Bartholomew, W. I. *Sept. 15th.* Fourteen jars of reptiles, containing fourteen species from various localities. *Nov. 3d.* Collection of remains of sixteen species of extinct Cetacea from the miocene of Charles Co., Md.; mounted skeleton of Palumedea cornuta; a collection of forty species of reptiles of the Orton Expedition to Equador; a collection of reptiles from Brazil and Central America. *Nov. 10th.* Crocodilus Americanus from Cuba. (See Welsh.)

Corse, Dr. J. M. *Dec. 1st.* Four skulls and casts of faces of noted murderers; numerous jars of embryo sheep of various ages, parasitic animals, fine injections for microscopic observation, and various specimens in comparative anatomy; skull of a Flat-head Indian; two skulls from an Indian mound near Rock Island, Ill.; skeleton of an Eagle; specimens of copper ore.

Craven, Joseph H. *July 7th.* Beautiful specimen of Euplectella.

Crosby, Peirce. *Aug. 4th.* Specimen of Fruit from Para, Brazil.

Davidson, Geo. *Jan. 7th.* Five specimens of the male and female skeleton of the Sea Otter, from Alaska. *March 3d.* Fifteen specimens of Fishes, 3 Echinoderms and 2 Crustacea from Alaska.

Davidson, Thos. and George. *Aug. 4th.* Large and valuable collection of Fishes from Santa Cruz, West Indies.

Davis, Edw. *July 21st.* Pair of antlers.

Day, Edw. *Sept. 1st.* A collection of Reptiles in five jars, from Equador.

Dieffenbaugh, E. See Burk.

Draper, E. *Jan. 14th.* Fine specimen of Pyrites with Blende from Mexico, and specimens of Quartz with Chalybite.

Eddy, Rev. E. B. *May 5th.* A collection of fossils, consisting of a large coral and 16 brachiopods.

Ellis, J. B. *March 3d.* Specimen of Tuckahoe, from Newfield, N. J.

Engelmann, G. *April 21st.* Herbarium Juncorum Boreali Americanoru Normale ed. G. Engelmann. St. Louis, 1868.

Gabb, Wm. M. *Jan. 7th.* Forty-five specimens, thirteen species of Reptiles from California. *Jan. 14th.* Skin of Taxidea Berlanderi, from Central Nevada; four species of Serpents from Lower California; two specimens of a Myriapod and nest of a Mygale from California. *Jan. 21st.* Two bats from Pigeon Springs, a small Rodent from Western Nevada, and a Crotaphytus from same locality; skull of a hare; skins of four species of snakes from Lower California. *Feb. 4th.* Two specimens of Onychoteuthis fusiformis, Gabb, from Society Islands; five species of Echinoderms from California; two species of Crustaceans from St. Barbara, Cal.; Hyalonema Sieboldii from Japan. *May 5th.* Eutænia vagrans from Nevada. *Oct. 13th* An Agouti from Panama. *Oct. 20th.* Two specimens of fossil fishes from Hillsborough, N. B. *Nov. 3d.* Collection of Graptolites, nine species, from Hudson River group, two miles below Albany, N. Y. *Nov. 10th.* A small collection of remains of fishes from the cretaceous formation of California. *Dec. 1st.* A large collection of fossils, consisting of about 500 species and 3000 specimens, belonging to the triassic, cretaceous and tertiary formations of California, Nevada and Oregon, deposited.

Genth, Dr. F. A. *Aug. 4th.* Specimens of Clausilia Braunii, Charpentier, from Weinheim, Hesse Darmstadt; ear-bone of Whale from Gulf of California.

Gibbon, Gen. John, through Dr. Wilcox. *Aug. 12th.* Baculite from near Fort Sanders, Dakota.

Gibbons, Dr. W. P, through Dr. Bridges. *Jan. 7th.* A collection of one hundred and seventeen California plants.

Goldsmith, E. *Oct. 20th.* Bole from South Amboy.

Greer, Col. Jas., through Dr. Ruschenberger. *Dec. 1st.* Five Devonian fossils from Columbus, Ohio; 26 Lower Silurian fossils from Dayton, Ohio; fragment of wood from Drift from Dayton, Ohio; fossil Coral from near same locality.

Grout, Rev. A. *Jan. 21st.* Ten species of Invertebrates and one Vertebrate, from Tulu Land, S. Africa.

Guillou, C. *July 7th.* A small miscellaneous collection of Minerals. *July 14th.* Fine Testudo geometrica, from Madagascar.

Hall, Geo. W. *March 3d.* Mastodon tooth from Illinois.

Hassler, Dr. F. A. *Dec. 22d.* Celestine from Sicily; one Coal, two Hematites from Bibb Co., Ala.; Hematite from Missouri; Mica from Philadelphia, and nine specimens of Coal Fossils from Rhode Island and Mauch Chunk, Pa.

Hayden, Dr. F. V. *April 21st.* Lignite from Colorado, a number of Ostrea subtrigonalis, and an Inoceramus from Colorado.

Hayes, Dr. I. I. *July 7th.* Two skulls of Walrus and two of Esquimaux Dogs.

Hoopes, B A. *Oct. 13th.* Fine large crystallized Calcite from Cumberland, England.

Horn, Dr. Geo. H. *Jan. 7th.* Three species of Reptiles from Arizona. *Feb. 4th.* Fresh-water Sponge, near Susanville, Honey Lake Valley, Cal.; tin ore from Temescal, Cal. *April 21st.* Pisidium from Fort Tejon, Cal.

Hornet's nest. *Jan. 7th.*

Hunt, Rev. W. E. *Nov. 3d.* Fragment of Ancient Pottery and Human Bones, with the greater portion of a Scull from Coshocton, Ohio.

Jeanes, Jos. *July 7th.* Skeleton of Jackal, from Syria.

Judson, Dr O. A. *Jan. 21st.* A small collection of Fossils from Pike Co., Pa., and the fossil rib of a Cetacean from Virginia.

Kokler, Wm. *Dec. 1st.* Four Fossils from Hannover, Germany.

Lambert, J. *June 23d.* A large Spider from Montgomery Co., Pa.

Lamborn, R. H. *Nov. 3d.* Two obscure Fossils from Huronian Slate, St. Louis R., Min.

Lavergne, Felix. *Oct. 13th.* Three specimens of native Sulphur from Nevis, W. I.

Lea, I. *Dec. 1st.* Scull of the Mississippi Snapper. (See Welsh.)

LeConte, Dr. J. L. *Jan. 14th.* A Serpent, Spider, Cicada, two Myriapods, and a Lizard from Fort Craig, N. M. *April 21st.* A collection of Fossil Tertiary and Cretaceous Plants, (recently described by Mr. Lesquereux) from Colorado, New Mexico and Kansas, an Inoceramus from Colorado. *May 19th.* A collection of upwards of 6000 species of exotic Coleoptera belonging to the late Dr. Zimmerman. Presented by Dr. J. L. LeConte, Dr. E J. Lewis, Dr. Geo. H. Horn, Dr. F. W. Lewis, Isaac Lea, S. S. Haldeman and E. Draper.

Leidy, Dr. Jos. *June 2d.* Stigmariæ and other coal plants, six species.

Lewis, Dr. E. J. *Jan. 7th.* Portion of the Jaw of a Fish. *March 17th.* One Nyctale Acadica, 2 Cardinalis Virginianus, Sialia Wilsonii, Picus Pubescens, from Harford Co., Md. *Oct.* 13*th.* Large collection of Nests and Eggs of Birds, from Harford Co., Md.

Lincecum, Dr. G. *Jan.* 7*th.* One hundred and four specimens, fourteen species of Reptiles from Texas.

Lyman, B. S. *Nov.* 3*d.* Asphaltum from Trinidad and Matanzas, Cuba; crystals of Smoky Quartz, from Mt. St. Gothard, Sd.

Matthews, C. W. *May* 5*th.* Sigillaria from Lawrence Co., Ala.

Meehan, Thos. *Jan.* 7*th.* Two fossil remains of Fishes, Amphidectes Gladiolus, Cope, and Polygryphus prehensilis, Cope; from Sandusky, Ohio.

Moss, Theo. F. *March* 24*th.* Crystallized Titanium, from Scotland.

Parker, H. R. *April* 14*th.* A large Devonian Fossil from Oil Creek, Venango Co., Pa.

Peale, Charles W. *June* 23*d.* Calamite from Shamokin, Cumberland Co.

Pennock, Homer. *July* 7*th.* Five fortification Agates, deposited.

Philips, Moro. *June* 2*d.* Three specimens of Ossite from Sombrera, W. I., and a specimen of the same from Ashley River, S. C.

Powell, Saml. *Sept* 1*st.* A miscellaneous collection of Marine Animals, consisting of Fishes, Mollusks, Echinoderms, Crustaceans, &c., from Newport, R. I.

Raborg, Wm. *Nov.* 3*d.* Chrysothrix Sciureus, from Amazon River.

Rand, Theo. D. *March* 3*d.* Stilbite from Flat Rock Tunnel. *March* 10*th.* Graphic Granite and Muscovite with Magnetic Iron.

Randall, F. A. *Sept.* 1*st.* Two jars of Reptiles from Warren Co., Pa. *Oct.* 20*th.* A small collection of Palæozoic Fossils.

Rice, John. See Welsh.

Rothrock, Dr. J. T. *March* 17*th.* A small collection, chiefly of Devonian Fossils, from Mifflin, Alleghany and Centre Co's, Pa.

Salt Works, Washington Co., Va. *Feb.* 4*th.* Tusk, molar tooth and epiphysis of humerus of Mastodon and ramus of lower jaw of a Bison.

Sergeant, J. D. *Oct.* 13*th.* Nest of the Baltimore Oriole, made exclusively of wool and horse-hair, from Western Pennsylvania.

Siebold, Prof. Von. *May* 19*th.* Teeth of seven species of Cyprinidæ, with many varieties of specimens.

Skin of an Eel, which weighed 9½ lbs., and was caught in Hunter's Lake, Sullivan Co., Pa.

Smith, T. Guilford. *March* 24*th.* Five specimens of Gold Ores from Colorado.

Smithsonian Inst. *May* 5*th.* Eight species of Amblystoma. *Aug.* 12*th.* Anodonta Yonkanensis, Lea. *June* 2*d.* Twenty species of Reptiles from Guayaquil, Quito and Upper Amazon.

Snell, P. A. *March* 10*th.* Mass of calcareous Tufa from Utica, Ill.

Snyder, W. B. *May* 19*th.* Indian Skeleton, &c., from a mound at Bellevue, Nebraska.

Struthers, Wm. *Oct.* 13*th.* Conglomerate from the red sandstone of Portland, Con.

Sumichrist, F. *Jan.* 7*th.* Eighty-six specimens, nine species of Fishes from Mexico.

Turner, Dr. Theo. H. *Dec.* 15*th.* A collection of fossil remains of a huge Saurian, comprising the greater part of the skeleton, described by Prof. Cope under the name of Elasmosaurus, from about 15 miles of Fort Wallace, Kansas.

Two fossil Fishes from Solenhofen Slate.

Tyson, Saml. *Oct.* 20*th.* Three specimens of Wavellite from Chester Co.

Ulex, Geo. J. *May* 19*th.* Specimen of Struvite from Hamburg.

United States Sanitary Commission. *Dec.* 15*th.* A set of instruments consisting of an Andrometer, Spirometer, Dynamometer, Facial-Angle Instrument and Callipers, for Anthropological measurements.

Vaux, Wm. S. *March* 3*d.* Fine specimen of Phlogopite, Rossie, St. Lawrence Co., N. Y. *March* 24*th.* Skull of Chelone Mydas. *July* 7*th.* Skeleton of Fox from Syria. *Oct. 6th.* Very fine specimen of Tetrahedrite, coated with Pyrites from Liskeard, Cornwall. (See Welsh.)

Walton, Jos. *May 5th.* Two tertiary fossil Shells from Aquia Creek, Va Acantharchus promotis from New Jersey. *Sept. 1st.* A Silurian Fossil from the Catskill Mts.

Welsh, Saml. and John. *Dec. 22d.* A portion of the Poirrier Collection of Remains of Mammals Birds and Fishes from the Miocene, Pliocene and Post-Pliocene formations of the Valley of the Loire, France. Purchased at a cost of $700.00, and presented by Messrs. Samuel and John Welsh, Isaac Lea, Wm. S. Vaux, Wm. P. Wilstach and John Rice. Obtained through Prof. E. D. Cope.

Westcott, Chas. S. *Dec. 1st.* Mounted specimen of a Goshawk, Astur palumbarius, from Monroe Co., Pa.

Wheelock, L. P. *Feb. 4th.* A collection of 58 specimens of fossils, consisting of remains of Fishes, Mollusks and Corals, from the corniferous limestone near Sandusky, Ohio.

Willis, J. R. *Jan. 14th.* A collection of Coal Fossils, Minerals, Shells and Crustaceans from Nova Scotia. *Jan. 21st.* Eight species of Fishes from Nova Scotia; six Invertebrates from same locality.

Wilstach, W. P. See Welsh.

Wood, Dr. H. C. *May 5th.* A collection of 19 bottles (containing numerous specimens) of as many species of Phalangidæ.

Wood, Wm. S. *Oct. 13th.* Young of Cyanura cristata, Picus pubescens and Melospiza melodia, from New Jersey.

Wright, Jas. A. *March 17th.* A complete articulated skeleton of the Irish Elk, (Cervus Hibernicus) together with the skull and fore part of the other bones of another skeleton.

Yarnal, H. *June 23.* Deer from near Kane, McKean Co., Pa.

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1868.

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NORWAY.

Christiana. Det Kongelıge Norske Fredericks Universitets, Aarsberetning for Aaret 1866—1867. From the University.

Forhandlingar i Videnskabs-Selskabet i Christiania. Aars 1865 and 1866, 1866—1867. From the Society.

Throndhjem. Det K. Norske Videnskabers-Selskabs Skrifter det 19de Aarhundrede. 5te Bands, 1ste Heft, 1865. Also from 2 Band, 1ste Heft, to 4de Band, 1ste Heft, 1824—1846. From the Society.

DENMARK.

Kjobenhavn. Oversigt over det Kongelije Danske Videnskabernes Selskabs. 1866, No. 7; 1867, Nos. 4 and 5. From the Society.

Mémoires de la Société Royale des Antiquaires du Nord, 1850—1860, 1861, 1866. From the Society.

Tillaeg til Aarbger for Nordisk Oldkyndighed og Historie, aargang 1866—1867. From the same.

Det Kongelige Danske Videnskabernes Selskabs Skrifter, Sjette Bind, and Femte Raekke, Syvende Bind, 1867. From the Society.

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Dorpat. Sitzungsberichte der Naturforschenden Gesellschaft zu Dorpat in den Jahren 1853—1863. From the Society.

Archiv für die Naturkunde Liv-Ehst und Kurlands. Herausgegeben von der Dorpater Naturforscher Gesellschaft. Erste Serie. 3er Band, 3e and 4e Lief.; 4er Band, 1e Lief., zweite Serie. Biologische Naturkunde, 6er Band, 1e ünd 2e Lief., 7er Band, 1e Lief., 1862—1867. From the Society.

Moscou. Bulletin de la Société Impériale des Naturalistes de Moscou, 1867, Nos. I—IV. From the Society.

Riga. Correspondenzblatt des Naturforscher Vereins zu Riga, 16er Jahrg, 1867. From the Society.

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Memoires de l'Académie Impériale des Sciences des St. Petersburg. VIIe Serie, Tome XI. Nos. 9—18, 1868. From the Society.

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Amsterdam. Jaarboek van de Koninklijke Akademie van Wetenschappen 1866. From the Society.

Verslagen en Mededeelingen der K. Academie van Wetenschappen. Afdeeling Letterkunde. Tiende Deel, 1866. From the Society.

Processen-Verbaal van der Gewone Vergaderingen der Koninklijke Akademie van Wetenschappen. 1866–7. From the Academy.

Rapport fait a l'Academie Royale des Sciences des Pays-Bas, section Physique. 1868. From the Academy.

Harlem. Archives du Musée Teyler. Vol. 1, Fasc 1, 2 and 3me, 1868. From the Museum.

Archives Neerlandaises des Sciences Exactes et Naturelles; published by the Dutch Society of Sciences. Vol. 2, Parts 3, 4 and 5. La Haye, 1867. From the Society.

GERMANY.

Altenburg. Mittheilungen aus dem Osterlande; published by the Gewerbe Vereine, Naturforschenden Gesellschaft and the Bienen wirthschaftlichen Vereine of Altenburg. Vol. XVIII, Parts 1 and 2, 1867. From the Societies.

Mittheilungen aus dem Osterlande, gemeinschaftlich herausgegeben von Küust und Handwerks-Vereine, von der Naturforschenden Gesellschaft und vom Landwirthschaftlichen Vereine zu Altenburg. Vols. 1—13. 1837—1857. From the Society.

Augsburg. Neunzehnter Bericht des Naturhistorischen Vereins in Augsburg, 1867. From the Society.

Berlin. Archiv für Naturgeschichte. Herausgegeben von Dr. F. H. Troschel. 32er Jahrg, 6es Heft, to 34er Jahrg, 1es Heft. From the Editor.

Zeitschrift für die Gesammten Naturwissenschaften. Herausgegeben von dem Naturw. Vereine für Sachsen und Thuringen in Halle. 29er, 30er und 31er Banden. From the Society.

Zeitschrift der Deutschen geologischen Gesellschaft. XIX Band, 2 Heft, to XX Band, 2 Heft. From the Society.

Physikalische Abhandlungen der K. Akademie der Wissenschaften zu Berlin aus dem Jahre 1866. Mathematische Abhandlungen aus dem Jahre 1866—1867. From the Society.

Monatsbericht der K. P. Akademie der Wissenschaften zu Berlin. Aug. 1867, to Juli, 1868. From the Society.

Sitzungs-Berichte der Gesellschaft Naturforschender Freunde zu Berlin im Jahre 1866—1867. From the Society.

Wochenschrift des Vereines zur Beförderung des Gartenbaues in den Königl. Preussischen Staaten für Gartnerei und Pflanzenkunde. Nos. 26—52, 1867; Nos. 1—28, 1868. From the Society.

Berliner Entomologische Zeitschrift. Herausgegeben von dem Entomologischen Vereine in Berlin. 11er Jahrg, 1867, 3es and 4es Vierteljahrsheft, und 12er Jahrg, 1es und 2es Vierteljahrsheft. From the Society.

Bonn, Verhandlungen des Naturhistorischen Vereines der preussischen Rheinlande und Westphalens. 24er Jahrg, 1ste und 2te Haffte, 1867. From the Society.

Braunschweig. Archiv für Anthropologie. 2er Band, 3es Heft; 3er Band, 1es and 2es Heft. From the Library Fund.

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Brunn. Verhandlungen des Naturforschenden Vereines in Brunn. Vol. 5, 1866, 1867. From the Society.

Budan. A Magyar Tudom. Akademia Eökonyvei. 1835—1862. 8 Vols., 4to. From the Royal Hungarian Academy of Science.

Cassel. Journal für Ornithologie. Herausgegeben von Dr. Jean Cabanis. Heft V and VI, XV Jahrg., and Heft I—III, 16 Jahrg., 1867. From the Wilson Fund.

Malakozoologische Blätter. Herausgegeben von Dr. Louis Pfeiffer. 15 Band, 1—5 Bog, and pp. 145 to 224. From the Wilson Fund.

Danzig. Schriften der Naturforschenden Gesellschaft in Danzig, 1868. From the Society.

Darmstadt. Notizblatt des Vereines für Erdkunde und Verwandte Wissenschaften zu Darmstadt. III Folge, V Heft, 1866. From the Society.

Dresden. Sitzungs-Berichte der Naturwissenschaftlichen Gesellschaft Isis in Dresden. Jahrgang 1867, Nos. 4 to 12; 1868, Nos. 1—6. From the Society.

Verhandlungen der Kaiserlichen Leopoldino-Carolinischen deutschen Akademie der Naturforscher. 33er Band, 1867. From the Society.

Frankfurt-am-main. Der Zoologische Garten. VIII Jahrg. 1867, No. 7, to 1868, No. 6. From the Editor.

Abhandlungen, herausgegeben von der Senckenbergeschen Naturforschenden Gesellschaft. 6 Bandes, 3 and 4 Heft. 1866–67. From the Society.

Jahresbericht über die Verwaltung des Medicinalwesens. Herausgegeben von dem Aerztlichen Verein. VIII Jahrg., 1864—1867. From the Society.

Freiburg, I. B. Berichte über die Verhandlungen der Naturforschenden Gesellschaft zu Freiburg I B. Band IV, Heft V, 1867. From the Society.

Görlitz. Abhandlungen der Naturhistorischen Gesellschaft zu Görlitz. 13er Band, 1868. From the Society.

Gotha. Mittheilungen aus Justus Perthes Geographischer Anstalt. XI, 1867, to IX, 1868. Ergangsungsheft, Nos. 22 and 23. From the Library Fund.

Göttingen. Nachrichten von der K. Gesellschaft der Wissenschaften und der Georg-Augusts-Universität aus dem Jahre 1867. From the Society.

Hannover. Funfzehnter, Sechszehnter und Siebenzehnter Jahresbericht der Naturhistorischen Gesellschaft zu Hannover, 1867. From the Society.

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Kiel. Zoologisches Magazin. Herausgegeben von Dr. C. R. W. Wiedeman. Band 1 and Band 2, Stück 1. Kiel, 1817, and Altona, 1823. From the Library Fund.

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Leipzig. Zeitschrift für Wissenschaftliche Zoologie, herausgegeben von Carl T v. Siebold und Albert Kölliker. 18er Band, 1es Heft to 3es Heft, 1868. Namen Register über Band, I—XV, 1868.

Archiv für Anatomie, Physiologie und Wissenschaftliche Medecin. Herausgegeben von Drs. Reichert und Bois Reymond. 1867, Heft 5, to 1868, Heft 3. From the Library Fund.

Jenaische Zeitschrift für Medecin und Naturwissenschaft herausgegeben von der Medicinisch-naturwissenschaftlichen Gesellschaft zu Jena. 3er Band, 4es Heft, 1867. From the Society.

Berichte über die Verhandlungen der k. s. Gesellschaft der Wissenschaftten zu Leipzig; Mathematisch-Physische Classe, 1866, Nos. IV and V, 1867, Nos. I and II, 1867. From the Society.

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Lund. Acta Universitatis Lundensis, 1865. Four parts, 1865—66. From the University.

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Offenbach, A. M. Achter Band des Offenbacher Vereins für Naturkunde über seine Thätigkeit vom 31 Mai 1866, bis 12 Mai, 1867. From the Society.

Pest. A. Magyar Tudomanyos Akademia Jegyzokonyvei. 1863—4—5. From the Royal Hungarian Academy of Science.

Magyar Akademiai Ertesito. 1859—1865. From the Royal Hungarian Academy of Science.

Mathematikai es Termeszettudomanyi Koslemenyek vonatkozolag v hazai viskonyokra I, II, III, Kotet, 1861—5. From the Royal Hungarian Academy of Science.

M. Tudom. Akademiai Almanach 1864—5—6. From the Royal Hungarian Academy of Science.

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Flora oder allgemeine botanische Zeitung. Published by the Royal Bavarian Botanical Society of Regensburg. New Series, vol. 25, 1867. From the Society.

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Stuttgart. Neues Jahrbuch für Mineralogie, Geologie und Palæontologie. Jahrg., 1867, 6es Heft, to 1858, 5es Heft. From the Editors.

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Wurttembergische Naturwissenschaftliche Jahresheft; 24er Jahrg., 1es und 2es Heft, 1868. From the Editors.

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Denkschriften der K. Akademie der Wissenschaften, Mathematisch Naturwissenschaftliche Classe, 26er und 27er Banden, 1867. From the Society.

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GENERAL INDEX.

Description of Seven New Species of AMERICAN BIRDS from various localities, with a note on Zonotrichia melanotis.

BY GEO. N. LAWRENCE.

[Continued from page 359.]*

5. Rhynchocyclus marginatus.

Front, top of head and hind neck dull plumbeous; back, rump, smaller wing coverts and upper tail coverts of a clear olive green; tail blackish brown with edges the color of the back; larger wing coverts and quills black, the primaries narrowly edged with yellow, the other quill feathers and the larger wing coverts broadly margined with clear light yellow; under wing coverts yellow; chin, throat and upper part of breast gray; middle and lower part of abdomen and under tail coverts light yellow; sides olivaceous gray; upper mandible black, the under whitish, clouded with brown; "irides brown;" tarsi and toes light brown.

Length (fresh) $5\frac{1}{2}$ in.; wing 2 1-16th; tail 2; bill scant $\frac{1}{2}$; tarsi 9-16ths.

Habitat.—Panama. Lion Hill, near Aspinwall. Male and female alike. Types in my collection.

Remarks.—In my Catalogue of Birds from New Granada (Annals of Lyc. of Nat Hist. N. Y., Vol. vii, p. 473) this species is referred to *R. sulphurescens*, Spix. I have always been impressed with a doubt of its correctness, and only during the past summer was I enabled to make comparison with undoubted specimens of *R. sulphurescens* from Brazil. They differ in the Brazilian bird being larger, with the head less plumbeous, the yellow of the under parts of a deeper color and more extended, the throat only being gray, and the under mandible of a much clearer color.

It differs from *R. cinereiceps*, Scl., which at first sight it much resembles, in being smaller and of a darker green, not inclining to yellowish, as in that species. It may be readily known by the broad yellow margins on the wing coverts and quills. In this last character it is most like *R. sulphurescens*, but the markings are paler and more conspicuous than in the specimens of that species which I examined.

6. Pipra? cinnamomea.

The general plumage is of a clear cinnamon color, brighter on the rump and tail, duller or somewhat brownish on the back and wing coverts, and paler on the under surface; the top of the head and occiput are of an olivaceous brown, with a concealed crest of reddish orange; the quills are liver-brown, with an edging of pale cinnamon on the outer webs; upper mandible dark brown, the under whitish at base with the end brown; tarsi and toes reddish brown.

Length 4 in.; wing $2\frac{1}{8}$; tail $1\frac{3}{4}$; bill 5-16ths; tarsi $\frac{1}{2}$.

Habitat.—The Upper Amazon. Type in my collection.

Remarks.—I have placed this species provisionally in *Pipra*, to which it most nearly assimilates, but it has the wings shorter and the tail longer, relatively, than in any other member of the genus I have been able to examine, and I know of no other species resembling it in color.

7. Harpagus fasciatus.

Plumage above blackish-brown, glossed with dark purple; the tail is blackish-brown, crossed above with four narrow bars of grayish-white, and ending with ashy-gray; the quills on the upper surface are umber-brown, crossed with dusky blackish bars, and on the under surface are white for two-thirds their length from the base, the remaining part ashy-gray, barred throughout with blackish-brown; the under wing coverts are buffy-white, spotted with dark-brown; each feather of the entire under surface is closely barred with white, rufous and dark brown, the rufous color prevailing most on the breast and

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* This portion of the paper was inadvertently left out by the editor.

sides, less on the thighs, and scarcely showing on the middle of the abdomen; under tail coverts white; the feathers of the upper part of the throat appear to be partly white, but they are too much soiled to judge with certainty; upper mandible black, the under yellowish-white; legs dark yellow, claws black.

Length (skin) about 12 in.; wing $8\frac{3}{4}$; tail $6\frac{1}{4}$; tarsi $1\frac{1}{2}$.

Habitat.—Guatemala. Obtained from Dr. C. H. Van Patten. Type in my collection.

Remarks.—This specimen, which seems to be fully adult, makes a third species of the genus *Harpagus*, the other two being *H. bidentatus*, Lath., and *H. diodon*, Temm. The characteristic toothing of the bill is strongly developed, but it otherwise differs so entirely from the above two species in all their stages of plumage, by the broad transverse markings of its under surface, that no comparison with them is requisite.

Note on Zonotrichia melanotis.

This species should be placed in the genus *Hæmophila*, and much resembles in distribution of its markings, *H. ruficauda*, Bp. That species I had not seen at the time I described *Z. melanotis*. They differ in the tail of my species being liver-brown instead of rufous, and in having the tail feathers edged with whitish. In place of the decided rufous coloring of the sides, abdomen and under tail coverts of *H ruficauda*, there is only a wash of that color in *melanotis*. The dark stripes on the crown and sides of the head are pure black; the corresponding ones in *ruficauda* are dark brown mixed with rufous. In the last named species there is a broad band across the breast, of dark ash; this part in my species has only an ashy suffusion. The smaller wing coverts of *H. ruficauda* are of an immaculate bright rufous, those of *H. melanotis* are less bright, with dark brown shaft stripes. The bill of *H. ruficauda* is larger, and in its general plumage it is the most rufous of the two species.

Mr. O. Salvin (Ibis 1868, p. 299) says of my species: "Possibly the same as *Hæmophila humeralis*, Cab." It apparently differs in many marked characteristics from the description given of that species.

BIOLOGICAL AND MICROSCOPICAL DEPARTMENT

OF THE

ACADEMY OF NATURAL SCIENCES.

On the evening of March 28th, 1868, a meeting of gentlemen interested in the organization of a Microscopical Society was held at the office of Dr. James Tyson, at which sixteen were present, while written or verbal communications signifying sympathy with the project were presented from at least as many more.

Dr. R. S. Kenderdine was called upon to preside and Dr. Tyson to act as Secretary. A letter from Prof. Jos. Leidy was read, urging the advantages of working under the Biological Department of the Academy of Natural Sciences. Such, or a similar plan of organization met with approval, and a committee, consisting of Drs. H. C. Wood, Jos. Leidy, Wm. Pepper, J. H. McQuillen and James Tyson, was appointed to take into consideration the propriety and feasibility of forming a *Microscopical* Department of the Academy of Natural Sciences, and to report at a meeting to be held Saturday evening, April 4th, at the same place.

April 4th, 1868.

President, R. S. Kenderdine, M. D., in the Chair.

Seventeen gentlemen present.

The Committee appointed at the last meeting reported, "It having been strongly urged by members of the Committee and influential members of the Academy of Natural Sciences, that we should not organize a purely Microscopical Department, we consider that the objects of the meeting will be most successfully attained by forming a Department or Section to be known as The Biological and Microscopical Department of the Academy of Natural Sciences of Philadelphia, which will combine the objects of the existing Biological Department and a Microscopical Society, in a manner to be determined in accordance with Chap. XIII of the By-Laws of the Academy, On the Creation and Government of Departments."

This report was adopted and the Committee continued to carry out its report.

MEETING OF BIOLOGICAL DEPARTMENT OF THE ACADEMY.

April 16th, 1868.

Director, Jos. Leidy, M. D., in the Chair.

Six members present.

The Director stated the object of the meeting to be to take into consideration the revival of the Biological Department of the Academy, and its union with a proposed Microscopical Department.

After some discussion, it was voted that a committee of three, including the Director, be appointed to confer with the Microscopical Society and point out the advantages to accrue from the proposed union, and afterwards to take such action in the Academy as shall be required to bring about such union. Drs. Leidy, Mitchell and J. A. Meigs were appointed.

Adjourned to meet on 1st Monday in May.

April 25th, 1868. *Proposed Microscopical Society.*

President, R. S. Kenderdine, M.D., in the Chair.

Twenty-three gentlemen present.

The Committee reported that on April 18th, 1868, they met a Committee of the Biological Department of the Academy, consisting of Drs. Jos. Leidy, Dr. S. W. Mitchell and J. A. Meigs, and as the result of this conference, were empowered to offer the following propositions to the meeting, if, in accordance with the resolutions of the first meeting, it be deemed desirable to unite with the Biological Department of the Academy.

I. The name of the present Biological Department shall be changed to Biological and Microscopical Department.

II. All microscopic apparatus and preparations now owned by the Biological Department will be freely available to the new Department.

III. The extensive microscopic library of the Academy will be accessible to them, and the purchase of new books can be secured from a fund provided for the purpose.

IV. Meetings can be held in the Hall of the Academy at whatever time appears desirable to the members of the Department, except the evenings of the stated meetings of the Academy, and the order of business can be arranged as desired.

V. A motion shall be urged upon the Academy that the amount of entrance fee and the annual contribution for the first year, of new members joining the Academy for the sake of becoming members of this Department, shall be voted as an appropriation to the Department.

On motion of Dr. Wm. Pepper, it was voted that if the advantages above detailed are granted by the Academy, it is deemed desirable that the gentlemen wishing to form a Microscopical Society unite with the body known as the Biological Department of the Academy, under the title of the Biological and Microscopical Department of the Academy of Natural Sciences of Philadelphia.

It was also voted that a committee of three be appointed to carry out the resolution and to take proper steps to have those gentlemen not members of the Academy made such. The Chair appointed Prof. F. G. Smith, Drs. H. C. Wood and W. Pepper.

Adjourned until called by the officers of the Biological Department.

Biological Department, May 4th, 1868.

Vice Director, S. W. MITCHELL, M. D., in the Chair.

Three members present.

The following gentlemen, also present, members of the Academy of Natural Sciences, on complying with the By-Laws of the Academy on the subject of Departments, were also declared members:—Wm. Pepper, M. D., H. M. Bellows, M. D., F. W. Lewis, M. D., Isaac Norris, M. D., James Tyson, M. D., Harrison Allen, M. D., H. C. Wood, M. D., R. S. Kenderdine, M. D., T. C. Stellwagen, M. D., J. H. McQuillen, M. D., J. G. Hunt, M. D., C. N. Peirce, D. D. S., C. A. Kingsbury, D. D. S.

Eleven gentlemen interested in the proposed Microscopical Society, but not members of the Academy, were also present by invitation.

Dr. J. H. McQuillen exhibited a number of sections of human teeth which he had prepared, demonstrating the *interglobular spaces in dentine*, and also made some extended remarks descriptive of his investigations in this direction, which he proposes to publish in the Proceedings.

Biological Department, May 19th, 1868.

The Director, JOS. LEIDY, M. D., occupied the Chair.

Thirteen members present; eleven, not members, present by invitation.

Dr. Tyson exhibited specimens of black crystalline forms, generally rhomboidal, obtained from fecal discharges, and which presented the characters of *hæmin* crystals, as described by Virchow in "Cellular Pathology."

Dr. S. W. Mitchell having recently studied the life of the rattlesnake, remarked, with regard to the growth of their rattles, that they are produced at all times, even when the reptile has been long deprived of food, and that they are not produced one in each year of the life of the reptile, as commonly thought.

Biological Department, June 1st, 1868.

Director, JOS. LEIDY, M. D., in the Chair.

Sixteen members present, also nine gentlemen, proposed members.

The following were declared members of the Department:—

Jno. Neill, M. D., T. L. Buckingham, D. D. S., R. W. Hargadine, M. D., E. L. Hewitt, D. D. S., Aug. F. Müller, M. D., Edw.

Rhoads, M. D., W. H. Trueman, D. D. S., James Truman, D. D. S., Chas. Shaeffer, M. D., Henry C. Chapman, M. D., W. W. Keen, M. D., W. Lehman Wells, M. D., T. H. Andrews, M. D., Geo. Pepper, M. D., D. Murray Cheston, M. D., Horace Williams, M. D., Herbert Norris, M. D., Chas. Bullock, W. L. McFadden, Joseph Zentmayer, W. H. Walmsley, T. W. Starr, Horace B. Hare, M. D., Prof. Robt. E. Rogers, M. D., and F. F. Maury, M. D.

The resignations of Messrs. McAllister, Atlee, Wilcocks and Ziegler were read and accepted.

Dr. J. H. McQuillen exhibited longitudinal and transverse sections, prepared by himself, illustrating the anatomy of the poison fangs of the rattlesnake. The fangs were from the head of a rattlesnake furnished to him by Dr. S. W. Mitchell.

Biological Department, June 16th, 1868.

WM. PEPPER, M. D., in the Chair.

Twenty-five members present.

Drs. J. L. LeConte, J. H. Packard and S. B. Howell were declared members of the Department.

The resignations of Mr. Constant Guillou and Drs. A. Hewson and Henry Hartshorne were read and accepted.

Dr. W. W. Keen exhibited some injected preparations mounted in sections, by Prof. Thiersch of Leipzic. Some of these were marvels of execution, more particularly as to the extent of the sections, being those of an entire kidney of a cat and rabbit, and similarly extensive tissues. They were mounted in balsam, and exhibited, for the most part vascular arrangement only.

At the election of officers this evening for the remainder of the year 1868, the following were chosen:—

Director, Wm. Pepper, M. D.

Vice Director, J. Gibbons Hunt, M. D.

Recorder, James Tyson, M. D.

Corresponding Secretary, J. H. McQuillen, M. D.

Conservator, Herbert Norris, M. D.

Treasurer, C. N. Pierce, D. D. S.

July 6th, 1868.

Director, WM. PEPPER, M. D., in the Chair.

Twenty-three members present.

Dr. H. C. Wood exhibited a section through the root of the *American mistletoe*, showing the intimate conjunction of the woody tissue of the parasite with that of its foster mother, as well as the distinctness of the two, and remarked on the fact that the green leaved phanerogamic parasite thus pierced into the region of the crude sap, while the tawny, scale leaved, such as the *beech drop*, are only capable of nourishing themselves with the elaborated sap, and that therefore they merely pierced the bark of their victim, their roots ramifying through the cambium layer.

Dr. J. G. Hunt remarked:

It is well known to botanists that in the pitcher of *Nepenthes distillatoria* there are numerous glands lining its internal surface, and extending from the extreme bottom up nearly to the middle of the pitcher. This system of glands has been described by Treviranus but never correctly figured that I am aware of. But if we examine with a common lens, the frill, or thickened edge surrounding the top of the pitcher, looking carefully along the inner and lower margin, we may detect numerous little apertures, leading into short canals, and terminating in as many large cylindrical glands which lie around the top of the pitcher like guns around a fortification. These glands lie imbedded in a parenchyma, made up almost entirely of large spiral cells, and this would seem to indicate considerable activity in their function, which, no doubt, is to pour down a multitude of trickling rills into the cavity of the pitcher. I am not aware that botanists have alluded to these glands before, and it is probable analogous ones exist in the other species of this genus.

Dr. Hunt also exhibited preparations illustrating the anatomy of *Drosera rotundifolia*, and remarked that

The glands terminating the filaments growing on the leaves are beautiful structures when rendered sufficiently transparent for observation. A spiral vessel traverses the centre of each filament and terminates at its free end in several large, elongated spiral cells. Around, and entirely enclosing this cluster of spiral cells, many columnar cells filled with granules are arranged, their long diameters pointing outwards, and a delicate epidermis envelops all. If the mature leaf be severed from the plant and placed in favorable conditions, adventitious buds will be formed on it, and thus a crop of young Droseras may be obtained. We have examined this plant in all its stages of growth, under lenses, and without them, and failed to detect any evidence of irritability, and while it doubtless does *catch* flies and other small objects by means of the adhesive liquid on the glands, it would seem that the conclusion drawn from this fact, namely, that the Drosera needs animal food *thus* for its growth, is, perhaps, premature. Has such fact ever been proved?

July 20th, 1868.

Vice-Director, J. G. Hunt, M. D., in the Chair.

Sixteen members present.

Donations.—A preparation of epithelial cancer of the larynx, presented by Dr. J. J. Woodward.

A photograph of acarus sacchari.

An official communication was received from the Recording Secretary of the Academy of Natural Sciences, containing an abstract of the minute of a recent meeting of the Academy, at which the following by-law was passed after the third reading.

"Art. xxi, of Chap. XIII. The Department A shall be denominated the Biological and Microscopical Department of the Academy of Natural Sciences of Philadelphia." Thus authorizing officially the new title of the Department.

BIOLOGICAL AND MICROSCOPICAL DEPARTMENT.

Aug. 3d, 1868.

Mr. Chas. Bullock in the Chair.

Eleven members present.

Aug. 17th, 1868.

Director, Wm. Pepper, M. D., in the Chair.

Fifteen members present.

Dr. J. Gibbons Hunt exhibited and described an improved Section instrument.

A brass tube, two inches long and three-fourths of an inch in diameter, is closed at one end; a circular brass plate two inches in diameter attached to the other end, and ground properly flat, forms the surface to guide the razor. Into this tube fits another, which is worked up or down by a screw working in a thread cut in the bottom of the outside tube. A slot cut *through the upper* end of the *outer tube* affords room for a lateral binding-screw, which is *attached to* and *carried* by the *inner tube*. The binding-screw presses against a moveable tongue of metal armed at the upper and inner side with minute points. On the opposite side of the inner tube are also points designed to hold an object more securely. The advantages of this improvement are obvious. It is cheap, and is peculiar in really answering the purpose for which it is made.

Cork is *unfit* for holding objects in a section instrument; some *firm* vegetable, such as a turnip or potato, for all *very delicate* preparations being far better.

Sept. 7th, 1868.

Director, Wm. Pepper, M. D., in the Chair.

Seventeen members present.

Dr. Wm. Pepper read a paper, illustrated by microscopical preparations, "On the action of phosphorous in poisonous quantities upon the animal economy."

See American Journal of the Med. Sciences, April, 1869.

George Roberts M. D., and Ferdinand A. Hassler, M. D., were chosen members of the Department.

Sept. 21st, 1868.

Director, W. Pepper, M. D., in the Chair.

Twenty members present.

A complete set of photographs of the 19 bands of Nobert's most recent test plate, the last four showing spectral bands only, were presented by the Surgeon General U. S. Army, through Dr. J. J. Woodward.

Dr. Leidy observed that having noticed in the recent edition of Gray's Manual of Botany, the description of a species of Wolffia, for the first time published as occurring in the United States, he was led to seek for it in the vicinity of Philadelphia, under the impression that he had long been familiar with a plant of the kind, but without knowing its true character. He was successful in his search, having found it growing abundantly in a ditch skirting the road near the Delaware River, below the built up portion of the city. It is accompanied by a profusion of *Lemna polyrrhiza* and *L. minor*.

Dr. Leidy exhibited specimens of the plant in a glass vial and also beneath the microscope. This, the smallest and simplest of all the true flowering plants, appears to be the *Wolffia Columbiana* of Karsten, to which the United States plant of other localities has been referred in Gray's Manual. The description in the latter is very brief, and the original is not accessible in our library. The plant is larger than indicated in Gray, and may be looked upon as a variety. It was described as follows:

The frond is oval or nearly globular, uniformly bright pea-green, smooth or slightly muricate, shining. Plant floating at the surface of the water, about two-thirds submerged with the long diameter horizontal. No distinctive appearance between the upper and lower surfaces. In a state of multiplication usually observed with the new frond projecting from within one end of the parent, of all sizes nearly, to that of the latter itself. When the new frond is separated, the parent is observed to appear truncate at the pole of separation with a cup-like concavity, surrounded by a thin hyaline margin, which is sometimes slightly everted. After the establishment of the cup, a succession of new fronds appear to be produced from it, and may be observed in different fronds in all stages of growth. The new fronds are slightly pedicellate, and the offspring of these appear to originate close to the pedicel. Size of the full grown frond from $\frac{1}{3}$ to $\frac{1}{2}$ a line in depth and breadth, with the length slightly greater.

Outer epidermis composed of hexagonal cells in outline, with an abundance of chlorophyl grains adherent to the interior surface. Cells of the margin of the cup for two or three rows twice the breadth but not more than half the depth of the others. Stomata remarkably few; not more than from two to four observed in a frond. Interior of the frond occupied with large spheroidal cells, three tl nes the diameter of those of the epidermis. Air occupies many of the interior cellular interspaces. Towards the point of attachment of the new frond, the cells of the parent diminish in size and these contain some brownish coloring matter.

The flowers and fruit of *W. Columbiana*, as observed in Gray's Manual, have not been seen in the United States, but the fruiting plant, it is also stated, has been recently discovered by Karston, in Venezuela. No flowers or fruit were detected in the Philadelphia plant.

Dr. J. H. McQuillen performed some experiments on animals with nitrous oxide before the Department, prior to which

He remarked that every one present is no doubt aware that the recent introduction of nitrous oxide as an anæsthetic in England, has been much opposed by a number of prominent medical men there, particularly Drs. B. W. Richardson and A. E. Sansom, both of whom have devoted years to the careful study of anæsthetics, and, on account of their observations, experiments and contributions to the literature of anæsthetics, have come to be regarded "as of authority" in such matters; and their combined opposition appears to have had considerable effect upon the medical profession, judging from the comments in the medical journals, and the reports of proceedings of medical societies opposing its use; but the dental profession of England, aware of the remarkable exemptiom from fatality which has attended the use of nitrous oxide in America—frequently in the hands of most ignorant persons—have determined to give the agent a fair trial. The result is not an uncertain one, and before another year passes by nitrous oxide, in the hands of the progressive members of the dental profession in Great Britain, will almost entirely supercede, as in this country, the use of ether and chloroform in the extraction of teeth, and there is no reason why it should not be employed in the minor and capital operations of general surgery.

Dr. Richardson, in addition to his opposition to the use of nitrous oxide as an agent that "had caused death in the human subject" (making this assertion notwithstanding the fact that, in 100,000 cases or more in which it has been employed in America, no fatal case can justly be attributed to it as the direct cause), said at a meeting of the Medical Society of London, that "*on animals it was so fatal that, with the utmost delicacy in its use, it was a critical task thoroughly to narcotize an animal with the gas without actually destroying life. In some cases, also, animals died after recovering from the insensibility.*"

In accounting for this fatality in man and animals, nitrous oxide has been denied the possession of anæsthetic properties, and the results obtained attributed to *asphyxia*, due to "suspension of oxygenation," as in cases of death from the inhalation of the fumes of charcoal or carbonic acid gas, rather than impressions made upon the brain directly by the agent. It is somewhat singular to have such an explanation offered in connection with a substance which supplies an excess of oxygen to the blood. It is not my intention, however, this evening, to enter into the consideration of how nitrous oxide acts upon the system; but with a view of testing the accuracy of the statement quoted which, as you will observe, was made in the most decided and emphatic manner, without the slightest limitation or reservation to repeat a series of experiments on some animals in your presence to whom I administered nitrous oxide before the members of the Odontographic Society, three weeks since.

The gas was then given as follows:

1st experiment—A white rabbit, in good condition, was placed upon the table, held by assistants, and Barker's flexible india-rubber hood adjusted over the face of the animal, so that it could inhale the gas directly from the gum-bag. A valve in the inhaler admitted of the ingress of nitrous oxide gas to the lungs, and of the egress of the carbonic acid from them. After some little resistance, the rabbit became sensibly affected by the gas, in a minute and a quarter fell over on its side perfectly motionless, so completely narcotized that, on being held up by the ears, feet, or tail, it made no resistance, and would have been taken for dead but for slight respiration and the evident movements of the heart on applying the hand to the chest. In two minutes and ten seconds it revived, and sprang from the table to the floor, apparently unaffected by the experience it had just passed through.

2d experiment.—Another white rabbit was treated in the same manner as the first, with the exception that the gas was applied for a longer period, (1m. 20 sec.), and the animal was much slower in recovering from the effects. Several of the gentlemen, indeed, thought that life had become extinct, but five minutes after the induction of narcosis, it was running about on the floor with its companion.

3d experiment.—A kitten, about four months old—which had been suffering from the distemper, refusing solid food during the preceding five weeks, and on drinking milk almost invariably vomited it—was then treated as the other animals had been. The resistance to the inhalation of the gas was much greater on her part, and the urinary organs were so much affected that quite a profuse discharge of urine occurred. In 1 m. 30 sec. the animal was completely narcotized, and remained in an inanimate condition for 1 m. 10 sec., when it gradually revived, and appeared none the worse for the free supply of the gas.

4th experiment.—The gas was then introduced into a bell-glass receiver over a water bath, and a frog placed under the glass; but apparently owing to the rapidity with which water absorbs nitrous oxide, the animal remained there for more than half an hour unaffected by it.

5th experiment.—Another frog was placed in a wet bladder, the opening of which was tied tightly around the nozzle of the inhaler, and the gas passed into the bladder; in 3 m. 33 sec. the frog was lying on his back perfectly motionless, the translucence of the bladder affording a view of his position and condition. On untying the string and taking the animal out of the bladder, the access of fresh air revived it at once, and it jumped from the table with its usual vigor.

These experiment occupied about one hour, and some idea may be gained of the freedom with which the agent was administered to the animals by the fact that about forty gallons of gas were used up. At the close of the evening, when the meeting adjourned, the animals were perfectly comfortable.*

Mr. Chas. Bullock remarked that the impression so commonly held as to the effect of the continued inhalation of oxygen has been recently shown to be erroneous, and suggested the possibility that the varying effects might be due to allotropic states, in one of which,

* All of these animals have been under my daily supervision during the past three months, since the performance of the experiment, and none of them have manifested any discomfort, but, on the contrary, are in a perfectly healthy condition, the kitten in particular having improved so much under the remedy that, in a day or so after inhaling the gas, it partook freely of its food, and has been quite active and playful ever since.

the absorption of a larger quantity of oxygen being at times permitted, death resulted; and at other times, in an opposite state of the gas in which none was absorbed, no harm resulted.

Dr. H. C. Wood stated that he had known the administration of nitrous oxide gas to a patient suffering with uterine colic to fail to produce anæsthesia.

Richard K. Betts was elected a member of the Department.

Oct. 5th, 1868.

Director, Wm. Pepper, M. D., in the Chair.

Twenty-seven members present.

Prof. Leidy directed attention to a specimen of a sponge which had been for many years in the Museum of the Academy, and had been presented by the late Dr. R. E. Griffith, who obtained it in the Island of Santa Cruz, W. I. It is especially interesting from its relationship with that most beautiful of all known sponges, the *Euplectella aspergillum*, and apparently also to that enigmatic body the *Hyalonema Sieboldii* of Japan. Specimens of both these were also exhibited. A beautiful one of the former, from the Philippines, presented to the Academy by Joseph Henry Craven. Several specimens of the *Hyalonema*, presented by Drs. Ruschenberger and Sinclair, consist of a twisted fasciculus or rope of long, coarse, translucent siliceous threads, partially invested with a brown verrucose membrane or bark. When the first specimen was presented to the Academy in 1860, (Pr. A. N. S. 1860, 85,) Prof. Leidy, as Curator, reported it as a part of a sponge with a parasitic polyp upon it. One of the specimens may have some significance as to the relation of the rope of spicules and its polyp covering. It has attached two shark eggs and part of the tendril-like cords of another. The tendrils clasp the rope and are also partially invested with the polyp crust. In the complete condition, the *Hyalonema* fasciculus appears always to be associated at one end with a sponge-mass. Originally described by Dr. R. E. Gray, the fasciculus was viewed as the axis of a coral of which the verrucose bark formed part, the warts constituting the polyps; and he supposed the fasciculus to grow as a parasite from the sponge, frequently seen in specimens attached to one of its extremities. This still appears to be the view of Dr. Gray, as announced in recent volumes of the Proceedings of the Zoological Society, etc.

Dr. Bowerbank views the siliceous rope, with its warty investment and the sponge mass at one end, altogether as the elements of a sponge. The warts or polyps of Dr. Gray he regards as the oscules of the sponge.

Schultze, in an elaborate memoir, (Die Hyalonemen) accompanied by beautiful plates representing the complete *Hyalonema*, as the result of his investigations, determines the sponge-mass and projecting siliceous rope to be together the elements of the sponge, and the warty investment of the rope to belong to a polyp to which he gives the name of *Polythoa fatua*. In the crusts or individual polyps he detected the arms filled with nettling cells.

Brandt views the siliceous rope and its investment as a polyp, and the sponge mass at one extremity as a parasite invading, ultimately to destroy the polyp.

Lastly, among the discordant views, Ehrenburg looks upon the siliceous rope as an "artificial product of Japanese industry."

Prof. L. continued, I shall not discuss this extraordinary difference of opinions among experts, but must confess that I view most favorably the theory that the sponge-mass and the siliceous rope together constitute the sponge *Hyalonema*, while the warty crust of the rope constitutes a parasitic compound polyp, the *Polythoa fatua* of Schultze.

The sponge from Santa Cruz, in its body and projecting fasciculi of siliceous threads, reminds one of the *Hyalonema* sponge with its siliceous rope, but the structure of the threads of the former more nearly resembles those of the anchor threads of *Euplectella*. It is evidently a different sponge from either of those just named, and may be called *Pheronema*.

The body of the sponge is oblong ovoidal, with the narrower end upward, and with one side more prominent than the other. The lower extremity is rather cylindroid and rounded truncate. The upper extremity is conical, with a truncate apex presenting a large circular orifice. This is about 4 lines in diameter and is the exit of a canal which descends in the axis of the sponge for almost half its depth, and then appears to divide into several branches. The sides of the sponge form thick dense walls to the cylindrical canal, which is of uniform diameter before its division.

In its present condition the sponge is of a light brown hue. Its surface exhibits an intricate interlacement of stellate, siliceous spiculæ, including a tissue of finer spiculæ of the same character, the whole associated by the dried remains of the softer sponge tissues. More or less fine sand, especially at the lower end of the sponge appears to be introduced as an element of structure.

From the lower end of the sponge there projects a number of distinct or separate tufts of siliceous spiculæ, looking like tufts of blonde human hair. In the specimen there are fifteen tufts projecting around two-thirds of the extremity of the sponge, but the remaining third of the extremity of the latter exhibits about ten orifices, from which as many additional tufts appear to have been extracted.

Length of the body of the sponge $4\frac{1}{4}$ inches; diameter at middle 22 lines, at lower end 15 and 17 lines, at upper end 8 lines. Length of tufts of spiculæ 2 inches. The coarser stellate spicules of the surface of the sponge in general have five rays, of which four are irregularly cruciform, while the fifth projects at a right angle to the others towards the interior of the sponge. The rays of the contiguous crosses form together a lattice work on the surface of the sponge, and the intervals are covered by the rays of the finer spiculæ which also in general have a five-rayed stellate character. The finer tissue in the interior of the sponge, seen through the lattice work of the surface, contains a multitude of spicules which differ from the others only in their minute forms. Some of the largest stellate spicules on the surface of the sponge have a stretch of three-fourths of an inch.

The spicules of the tufts projecting from the sponge are two or three inches in length and vary in diameter. They become attenuated towards both extremities, but especially that inserted into the sponge-mass. Starting from the latter, they are at first smooth, then finely tuberculate; the tubercles gradually become converted into well marked recurved prickles or hooks, and finally the spicules end in a pair of longer hooks, recalling to mind the arms of an anchor. The spicules bear a near resemblance to those at the lower extremity of *Euplectella*, but have only two instead of four hooks at the end. In the specimen but few of the spicules present the complete character as described, most of them apparently having been broken.

The object of the tufts of spicules with their recurved prickles, and anchor-like free extremities, in *Pheronema* would apper to be to maintain the position or preserve the anchorage of the sponge in its ocean home, and perhaps in the living animal they are incessantly produced as occasion may requre, just as a *Mytilus* or a *Pinna* renews and attaches its threads of byssus to secure its position.

The siliceous spicules of *Pheronema* are composed, as in sponges generally, of concentric layers, and exhibited a delicate tubular axis. A spicula from one of the tufts measured as follows:—

Spread of the anchor one-tenth of a line; shank of the anchor one-thirtieth of a line; prickled portion of shaft one-fortieth of a line; shaft where thickest and without prickles one-eighteenth of a line, thinning out to the inserted end where it was not more than 1-300th of a line.

The species I propose to dedicate to my wife under the name of *Pheronema Annæ*.

Dr. Leidy fur remarked, that if any of the members desired to examine

Euglena viridis, he had observed it in great profusion on Friday last in a ditch skirting the Delaware road below the coal oil depot, south of the built portion of the city. The water looked in the spot as if Schweinfurt green had been strewed on the surface. He also exhibited drawings of a species which appeared to be an undescribed one, and which he had several times noticed late in the spring and early summer some years ago. The drawings were made from specimens obtained in a pond near Gloucester, N. J., in May, 1858. The water of the pond was thickly coated with a ferruginous red color due to the *Euglena*. The infusorium is not of a blood-red hue, as is stated to be the case in *Euglena sanguinea*, but is of a uniform ferruginous red. Upon keeping the animalcule a few days in a glass vessel exposed to the northern light, the exterior of the contents assumed a bright green hue, and the red eye point, previously invisible, came into view, while the central mass of contents remained of the original color. The animalcules remained in this condition subsequently until they died. In motion the animalcule assumed the various forms observed in *E. viridis* and other species. It would elongate to about 1-15th of a line by the 1-75th of a line wide. In the resting condition assuming a globular form, it measured 1-37th of a line in diameter.

The head is obtuse; the mouth oblique; the tail acute, and the flagellum is about the length of the body. Generally two nucleus-like vesicles occupied the interior, besides a clearer space around the position of the eye-point.

Dr. R. W. Hargadine exhibited some beautiful crystals of hæmato-crystallin, prepared by himself after the method of Bojanowski, who takes a quantity of blood drawn from a vein, or better from the blood vessel of an animal after death, and places it from two to four days in a cool place, until the blood corpuscles begin to form a thick, dark red, or black mass. A drop of this fluid is placed on a slide, covered, and placed in a dark place for several hours, when the crystals begin to form.

Dr. Chas. H. Thomas was elected a member of the Department.

Oct. 19th, 1868.

Director, Wm. Pepper, M. D., in the Chair.

Twenty-two members present.

Dr. H. C. Wood, Jr., called the attention of the Department to the manner in which one of the plant inhabitants of the ditches below the city produces its *zoospores*. The plant in question is filamentous, and grows in great numbers attached to twigs, bits of dead grass, splinters of wood, &c., in stagnant or partial stagnant water.

At its maximum size it is very apparent to the unaided eye, and is of a dark green or even blackish color. Such large filaments are perfectly opaque and are composed of numerous cells. The base of the filament is narrowed, and at irregular intervals in its length there are very marked contractions. The younger filaments are uniform and composed of a single series of cells. The *zoospore* is of the ordinary conical form, with the usual transparent space at the smaller end, from which arise three long cilia. The living *zoospore* soon becomes attached by its pointed end to some support, its cilia withering away, and commences to elongate at the expense of its transverse diameter. At the same time it acquires a cellulose coat. After a while the cell thus formed divides transversely into two. Growth continuing, each of these cells after attaining a certain size, again divides transversely, and so the process goes on, until finally a long filament is produced, which is composed of a single series of cells placed end to end. When this filament has reached a certain stage of development, one of two things occurs, either the cells begin to divide in the direction of their length, or the production of *Zoospores* takes place. In the first instance each cell divides into two, four, &c., cells, so that in the filament a number of cells lie side by side, and from this compound filament the large matured trichoma is formed by a continuation of growth and division. The *zoospores* are formed only in the younger fronds, these old compound trichomata appearing to be incapable of developing them. The endochrome in a cell about to produce *zoospores* divides into several more or less irregularly globular or pyriform masses. This change takes place almost simultaneously in a number of consecutive cells. The walls of the cells now undergo some alteration, whereby they become soluble in water. And as the division of the endochrome occurs first in the most distant cells of the filaments, so does also this change in the cellulose coats. Solution of the walls now takes place, the partitions between the cells disappearing, and the outer walls opening out, separating from one another. At the same time the *zoospores* begin to move uneasily, rolling on themselves, pushing forward, &c., and soon make their exit in a long stream which issues from the end of the filament.

This plant appears to be the same as that described by Kützing under the name *Schizomeris Leibleinei.* No European observer has, however, as yet noticed the manner in which the latter produces its *zoospores*, and therefore it is impossible to be certain in the identification. If *S. Leibleinei* should be found to differ essentially in the mode of giving birth to *zoospores* from the American species, the latter will form the type of a new genus.

For the present it seems better, however, to consider the two identical.

Jno. Tomes, F. R. S., London, was chosen a corresponding member of the Department.

Nov. 2d, 1868.

Mr. Chas. Bullock in the Chair.

Twenty-six members present.

Mr. T. W. Starr presented to the Department twelve slides, illustrating the anatomy of miscellaneous insects, among which is the seventeen-year locust.

Nov. 16th, 1868.

Director, Wm. Pepper, M. D., in the Chair.

Twenty-six members present.

Mr. W. H. Walmsley donated twelve slides illustrating vegetable structure.

Dr. F. W. Lewis donated slides of miscellaneous objects.

Dr. Wood exhibited to the Department fruiting specimens of a fresh-water *Alga*, which he had found near Chelten Hills, Montgomery County, growing in a rapidly flowing creek, on stones, which it covered more or less completely with a dark purplish, mucous coating. He stated that it might be referred, with some doubt, to the European plant, *Chantransia chalybea*, from which it differs, however, in its habit of growth, as well as in the filaments being much thicker and nearly twice as long. He gave the measurements of the oval spores as about $\frac{1}{3750}$ in the transverse, by $\frac{1}{2500}$ in the long diameter. The diameter of the filaments is about the $\frac{1}{2500}$ of an inch.

The doctor also exhibited specimens of a new species of *Palmella*, collected on the banks of the Schuylkill above Manayunk, which grew on the faces of rocks, kept constantly wet by dripping spring water. He proposed for the plant the name of *Palmella Jesseni*, after Prof. Jessen, of Prussia, and gave the following specific description of *P. Jesseni*, n. sp.

P. thallo expanso, initio dilute aut læte viride, molle, pellucidulo, ætate provecta firmo, tuberculoso, saturate olivaceo viride; cellulis globosis vel ellipticis, in thalli ætate immaturo plerumque singulis aut geminis et sæpe sparsis, in thallo maturo sæpe in familias connexis, plerumque confertis; thalli maturi tegumentis plerumque distinctis, thalli immaturi plerumque diffluentibus.

Diam. cell. glob. max. $\frac{1}{3500}$

Cell. oblong. long. max. $\frac{1}{2500}$

Dr. Samuel Lewis was chosen a member of the Department.

Dec. 7th, 1868.

Vice Director, J. G. Hunt, M. D., in the Chair.

Twenty-five members present.

Dr. F. W. Lewis presented to the Department a microscope, with box, bull's eye condensed, two eye pieces and three objectives, including 1 in., $\frac{1}{8}$, and $\frac{1}{12}$, for which the thanks of the Department were formally rendered.

S. Weir Mitchell made the following remarks upon the general resemblance in the effects caused by the venom of the various genera of poisonous serpents.

Several years ago, I reached the conclusion that the bite of the European viper and that of our own rattlesnake, produced identical symptoms. Since then I have been able, from experiments, to extend this conclusion to the copperhead. A very close study of Russel's experiments upon the East Indian snakes, particularly the cobra, and a like analysis of the results obtained by Guyon in Africa, and Rufz in Martinique, make it probable that all the serpents studied by these observers occasion symptoms which are so much alike as to make it impossible from these alone to state which snake inflicted the wound. The difference is one of degree and never one of kind.

Several months ago I received from Dr. Halford, of Victoria, Australia, a paper on venom poisoning. In replying, I enclosed a dried specimen of rattlesnake poison, with which he made comparative experiments. These appear to confirm the resemblance between the cobra and our own serpents At the same time Dr. H. states that the tiger-snake differs from the cobra in that its venom occasions but trifling or no local symptoms. He also adds that after death from this serpent's bite, the body does not putrify quickly, but is rather preserved thereby from decomposition. This seems to me so remarkable—so exceptional indeed—as to make it very desirable to have it set beyond doubt by further experiments. Apart from this single case, the identity of all known snake poisons seems to be well established.

Dr. J. G. Hunt exhibited an entire pitcher of the Nepenthes Distillatoria, prepared to show the situation of the previously undescribed glands, to which he some months ago called the attention of the Department.

Dr. L. S. Bolles exhibited a new clinical microscope, constructed by Mr. Tolles, of the Boston Optical Works, on a plan proposed by Dr. Cutter of Mass. The microscope possessed a one-fifth objective, and resembled somewhat the tubular part of Dr. Beale's clinical microscope. It was, however, provided with a *screw* movement for the adjustment, which secured a smooth and sufficiently rapid approximation of the object glass towards the object, without the disadvantages so evident in the sliding movement of a tube within a tube. It was unprovided, however, with any special means of illumination, being intended to be used with diffused daylight, or directed towards a source of artificial illumination.

At the annual election for officers held this evening, the following were chosen:—

Director, S. W. Mitchell, M. D.
Vice Director, Wm. Pepper, M. D.
Recorder, James Tyson, M. D.
Corresponding Secretary, J. H. McQuillen, M. D.
Conservator, Herbert Norris, M. D.
Treasurer, C. N. Pierce, D. D. S.

Dec. 21st, 1868.

Director, S. W. Mitchell, M. D., in the Chair.

Twenty members present.

Dr. J. H. McQuillen exhibited, in further illustration of his previous communication, slides of blood corpuscles of men and lower animals to which chloroform and nitrous oxide had been administered, to show that there was no morphological change in these bodies after administration of anæsthetics, as contended for by B. W. Richardson, Sanson and others. The doctor also exhibited slides of blood corpuscles with which chloroform and ether had been brought in actual contact, producing under these circumstances actual disintegration. Dr. McQ. believes that the anæsthetics act primarily upon the nervous centres, as early contended for by Flourens and the French physiologists generally.

Mr. W. H. Walmsley called the attention of the Department to the very great merits of Glycerine jelly as a medium for preservation of every description of objects, animal or vegetable, and exhibited specimens of both. I was led to experiment with it about one year ago, owing to the unsatisfactory results obtained from the use of balsam in many classes of objects, its high refracting power rendering many delicate tissues invisible, which are seen perfectly in the jelly. At first I was not very successful, having followed the formulæ of Davies and other English authorities in making it; the intense heat of our early summer liquified it, and spoiled many specimens. After many experiments, I arrived at a satisfactory result, the fluid readily jellying in an hour or two during the hottest days of August.

The advantages of this medium I deem to be various and obvious, and that it combines within itself more than are possessed by any other with which we are as yet acquainted. Its preservative qualities I believe to be unsurpassed, for nearly every description of tissues or structure, animal or vegetable; it preserves the colors of the latter in absolute perfection, it is very readily prepared and used, it attaches the covering glass to the side with sufficient tenacity for all practical purposes, whilst the finishing ring of varnish will render it quite secure. It is equally available for objects requiring to be mounted in deep cells, and there is no danger of leakage, as is the case with all fluids; it can be readily removed from slide and cover with hot water, if necessary. The refractive powers of the glycerine are sufficient to render all inert structures transparent, whilst even the delicate lines upon the scales of a mosquito's wing, are as distinctly visible as though mounted dry.

Finally, I desire, in bringing the subject before the Department, and mentioning my experience with its use, to interest other members in the matter, to induce them to try it, and to bring together from time to time the results we may severally arrive at. For I conceive it to be almost as important to arrive at a means of *preserving permanently* objects suitably prepared for scientific observations, as to be able to prepare them for such observation without reference to their preservatiou. Since we can only hope to arrive at accurate conclusions by repeated study, not by one, but many observers, this can only be done by having the object suitably prepared and permanently preserved.

The formula for making glycerine jelly is as follows:

Take one package of Cox's gelatine, wash repeatedly in *cold* water, then place in a vessel and add sufficiently *cold* water to cover it. Allow it to soak an hour or two, pour off superfluous water, add one pint of *boiling* water, place vessel on fire and boil for ten or fifteen minutes. Remove from fire, and when cool, but still fluid, add the white of an egg, well beaten, replace on the fire and boil until the albumen of the egg coagulates. Strain while hot through flannel, and add an equal portion by *measurement* of Bower's pure glycerine, and fifty drops of carbolic acid in solution; boil again for ten or fifteen minutes, and again strain through flannel, place in water bath, and evaporate to about one-half, then filter into two oz. broad-mouthed vials. (Cotton is the best filtering medium.)

To use the jelly in mounting objects:—Place the stock bottle in a small jar of boiling water; when it becomes fluid, a sufficient quantity must be removed to the slide (previously warmed), with a glass rod; the object, (previously soaked for some hours in equal parts of glycerine and distilled water, with a few drops of alcohol,) is to be placed in the drop of fluid jelly, a cover applied and slight weight placed upon it to exclude superfluous jelly. When cold, clean off the slide with a knife and wash in cold water; finish with a ring of gold size or shellac varnish.

NOTE.—Dr. Carpenter cautions against use of Glycerin with objects of a calcareous nature, as it is a solvent of carbonate of lime.

Mr. Chas. Bullock remarked that it is important to give the gelatine frequent washings previous to use, to remove traces of sulphuric acid, which invariably remain from the process employed in its preparation.

Mitchell W. McAllister, S. Fisher Corlies and Dr. J. G. Richardson, were this evening chosen members of the Department.

Prof. O. W. Holmes, of Boston, was chosen a corresponding member.

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